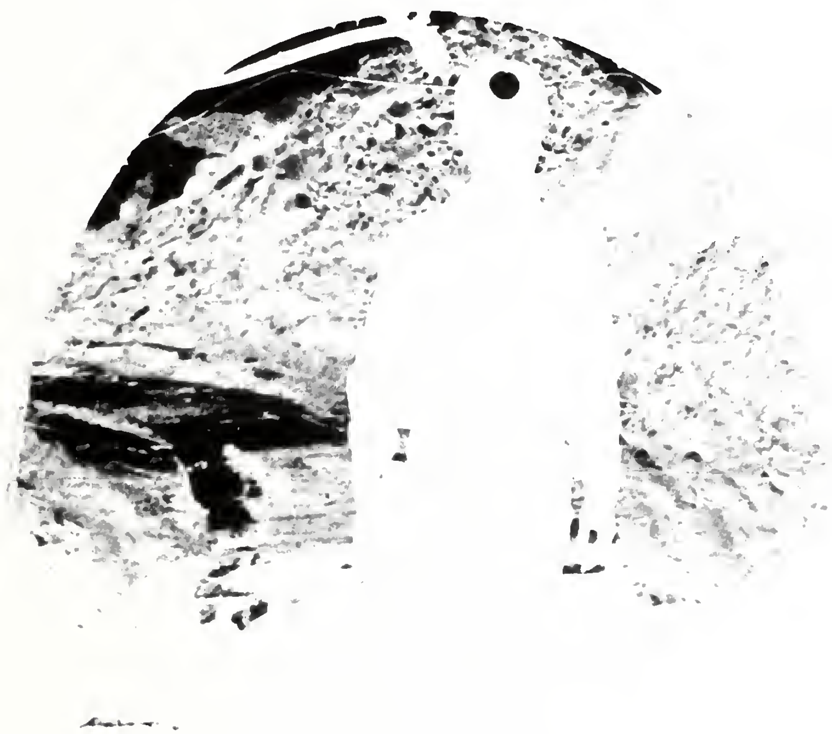
FINAL
ENVIRONMENTAL IMPACT STATEMENT

- Iron Point Exploration License
- Iron Point Coal Lease Tract
- Elk Creek Coal Lease Tract
Delta and Gunnison Counties, Colorado
February 2000



Lead Agencies:

USDA Forest Service

USDI Bureau of Land Management

Cooperating Agency:

USDI Office of Surface Mining Reclamation & Enforcement

FINAL
ENVIRONMENTAL IMPACT STATEMENT

Iron Point Coal Lease Tract
Elk Creek Coal Lease Tract
Iron Point Coal Exploration License

U.S. Department of the Interior - Bureau of Land Management
Colorado State Office
Uncompahgre Field Office

U.S. Department of Agriculture - Forest Service
Rocky Mountain Region
Grand Mesa, Uncompahgre and Gunnison National Forests

Cooperating Agency: U.S. Department of the Interior
Office of Surface Mining Reclamation and Enforcement
Western Regional Coordinating Center

February 2000

FINAL ENVIRONMENTAL IMPACT STATEMENT

Iron Point Coal Lease Tract
Elk Creek Coal Lease Tract
Iron Point Coal Exploration License

FEBRUARY 2000

Lead Agencies: USDI, Bureau of Land Management, Colorado State Office
USDA, Forest Service, Grand Mesa-Uncompahgre-Gunnison National Forests

Cooperating Agency: USDI, Office of Surface Mining Reclamation and Enforcement, Western Regional Coordinating Center

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Abstract: The Final Environmental Impact Statement (EIS) describes the physical, biological, social, and economic resources that would be potentially affected by leasing of the Iron Point and Elk Creek Coal Lease tracts as well as issuing an exploration license for an area within and surrounding the Iron Point Coal Lease Tract. The federal decisions to be made involve the approval or disapproval of coal leasing (the Iron Point and Elk Creek tracts) and of an exploration license. Some of the key issues for these proposed actions include: the potential effects of transporting over 19 million tons of coal per year from the North Fork Valley on the Union Pacific Railroad, the effects of increased highway traffic on State Highway 133; the potential effects to the integrity of watersheds and irrigation facilities within and surrounding the lease tracts, the effects to the local social and economic structure of Delta and Gunnison counties, and the cumulative effects of coal exploration and mining activities.

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FINAL ENVIRONMENTAL IMPACT STATEMENT

IRON POINT EXPLORATION LICENSE
IRON POINT COAL LEASE TRACT
ELK CREEK COAL LEASE TRACT

FEBRUARY 18, 2000

Dear Ladies and Gentlemen:

Enclosed for your review is the North Fork Coal Final Environmental Impact Statement (EIS). This document describes the existing environmental conditions and the potential effects associated with the leasing of the Iron Point and Elk Creek Coal Lease Tracts located in Delta and Gunnison counties, Colorado. The EIS also describes the environmental effects of granting a coal exploration license on an area within and surrounding the Iron Point Coal Lease Tract.

The U.S.D.I. Bureau of Land Management (BLM) and the U.S.D.A. Forest Service (Forest Service) are the joint lead agencies in the preparation of this EIS. The Office of Surface Mining Reclamation and Enforcement (OSM) is a cooperating agency on this EIS.

To aid in the preparation of the Draft EIS, we held a public scoping meeting on Wednesday, April 21, 1999 in Hotchkiss, Colorado. The Draft EIS was published and available for public review and comment on September 3, 1999. An informational public meeting was held on October 7, 1999. A public hearing was held on October 14, 1999 to accept testimony and comments. Both meetings were held in Hotchkiss, Colorado. The public comment period ended on November 3, 1999. The healthy debate and many constructive comments generated during the public involvement process greatly assisted the BLM and the Forest Service in identifying issues and preparing the environmental analysis in this Final EIS. We want to thank you for your participation in this project and hope you find the analysis responsive to your concerns.

Some of the key issues for this project include: the potential effects of coal shipping from the North Fork Valley on the Union Pacific Railroad; the effects of increased coal truck traffic on State Highway 133; the potential effects to the integrity of watersheds and irrigation facilities within and surrounding the lease tracts, including the Terror Creek Ditch and the Terror Creek Reservoir; the effects to the local social and economic structure in Delta and Gunnison counties; and the cumulative effects that coal exploration and mining might have on the region.

Besides the No-Action Alternative (Alternative A) and the coal leasing as applied for by Bowie Resources Ltd. and Oxbow Mining Inc. (Alternative B), we examined two other alternatives in the completion of the Final EIS. In these other alternatives, we analyzed the possibility of multi-seam mining and the restriction of subsidence due to underground mining in key sensitive areas.

Alternative D is the agencies' preferred alternative and the environmentally preferred alternative.

Copies of the Final EIS, and other relevant documents such as the scoping report, are available for review at the following locations:

Bureau of Land Management
Uncompahgre Field Office
2465 S. Townsend Avenue
Montrose, Colorado 81401

Forest Service
Paonia Ranger District Office
North Rio Grande Avenue
Paonia, Colorado 81428

Bureau of Land Management
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215

Office of Surface Mining
1999 Broadway, Suite 3410
Denver, Colorado 80202

Forest Service
Supervisor's Office
2250 Highway 50
Delta, Colorado 81416

Copies of the Final EIS have also been placed in the local libraries in Paonia, Hotchkiss, Delta, Montrose, and Grand Junction. Due to the minor comments and revisions on the figure volume, the figure volume has not been republished with the Final EIS. The reader will need to refer to the existing figure volume when referenced in the text of the Final EIS.

This EIS is not a decision document. The BLM and Forest Service will document their decisions on coal leasing and the exploration license in documents known as Records of Decision (ROD). The BLM requires a 30-day waiting period before the ROD can be issued. The BLM and Forest Service will issue their RODs concurrently. The public may anticipate the agencies to publish their RODs on or about March 27, 2000.

The agencies' decisions for actions affecting lands under their jurisdiction are appealable. Appeals filed on Forest Service decisions must be filed pursuant to regulations at 36 CFR 215. Appeals filed on BLM decisions must be filed pursuant to regulations at 43 CFR, Part 4 and Form 1842-1. Additional, specific information on filing appeals will be included in the RODs.

In conclusion, we would like to refer the reader to Chapter 1, Section 1.7.3, Community Efforts, in this Final EIS. The North Fork Coal Working Group (NFCWG) is a community based group representing a broad spectrum of interests in the North Fork Valley. The NFCWG has worked to address issues related to growth and coal mining in the valley and to develop a vision for the community's future. Their review and comments on the Draft EIS have been helpful to the agencies in the preparation of this document. The work of this group is expected to continue into the future. The public is encouraged to contact the NFCWG for current, specific information related to their efforts.

Further information on the North Fork Coal Final EIS can be obtained by contacting Jerry Jones at the BLM Uncompahgre Field Office, 2465 S. Townsend Avenue, Montrose, Colorado 81401, telephone (970) 240-5338, fax (970) 240-5368, or e-mail Jerry_Jones@co.blm.gov.

Respectfully submitted,

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Field Office Manager
BLM Uncompahgre Field Office

Robert Storch
Forest Supervisor
Grand Mesa, Uncompahgre and Gunnison National Forests

Summary

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SUMMARY

S-1.0 INTRODUCTION

The Bureau of Land Management (BLM) Colorado State Office and the USDA Forest Service (Forest Service) Grand Mesa, Uncompahgre, and Gunnison National Forests (GMUG) are joint lead agencies considering two lease-by-applications (LBA) for federal coal and a coal exploration license in the North Fork of the Gunnison River Valley. The west lease tract is known as the Iron Point Tract, and BLM has assigned this tract serial number COC-61209. This tract covers approximately 3,403 acres of federal coal in Delta County, Colorado. The LBA tract to the east is known as the Elk Creek Tract; the BLM has assigned this tract serial number COC-61357. This tract covers approximately 3,703 acres of federal coal in both Delta and Gunnison counties, Colorado. The coal exploration license application is on unleased lands within and adjacent to the Iron Point Coal Lease Tract; the BLM has assigned this exploration license area serial number COC-61945. The exploration license area contains approximately 6,053 acres.

In January of 1999, as part of the National Environmental Policy Act (NEPA) public process, the BLM and Forest Service determined that the requirements of NEPA would be best served by preparing a consolidated EIS for the two coal lease tracts and the exploration license area.

As required by NEPA, a scoping process was initiated in March 1999 to solicit comments from the general public, businesses, special interest groups, and government agencies regarding the coal leasing and an exploration license. On April 13, 1999, a Notice of Intent to prepare an EIS was published in the Federal Register by the BLM and the Forest Service. A public scoping meeting was held in Hotchkiss, Colorado on Wednesday night, April 21, 1999. The formal scoping period ended on May 17, 1999.

The Draft EIS was filed with the EPA and distributed to the public in late August 1999. The Notice of Availability for the Draft EIS was published in the Federal Register on September 3, 1999. A public information meeting was held on the evening of October 7, 1999 at the Hotchkiss High School (Hotchkiss, Colorado) to explain and answer questions on the Draft EIS and the coal leasing process. A formal public hearing was held on the evening of October 14, 1999 at the Hotchkiss High School for interested individuals and organizations to make oral comments and statements on the Draft EIS.

The formal comment period on the Draft EIS ended on November 3, 1999. Over 750 individual comments were received. The majority of the comments were classified in the categories of socioeconomics, transportation, and noise.

S-1.1 Proposed Action

There are three proposed actions associated with this EIS:

- Lease the Iron Point Coal Lease Tract on federal lands in Delta County, Colorado, for underground coal mining;
- Lease the Elk Creek Coal Lease Tract on federal lands in Delta and Gunnison, counties, Colorado, for underground coal mining; and,
- Issue an exploration license for coal exploration on federal lands in Delta County, Colorado.

S-1.2 Purpose and Need

With the preparation of the North Fork Coal EIS, the BLM and Forest Service are responding to coal lease tract applications submitted by Bowie Resources Ltd. (Bowie) and Oxbow Mining Inc. (Oxbow), as well as an exploration license application submitted by Bowie under procedures set forth in 43 CFR 3400. The purpose and objective for Bowie and Oxbow with regard to the Iron Point and Elk Creek Coal Lease tracts, respectively, are to continue their existing coal mining operations.

Bowie requested the Iron Point Coal Lease Tract in order to maintain reserves to supply potential customers and to economically justify the installation of a longwall mining system. The federal coal deposits in the Iron Point Coal Lease Tract are a logical extension to the existing operations at the Bowie No. 2 Mine.

Bowie also filed for the exploration license in order to obtain additional information regarding coal resources in the Iron Point Coal Lease Tract and areas to the north of the tract. Such exploration is required to further delineate the extent of the coal resources in this area, as well as to obtain coal quality information. Ark Land Company (an affiliate of Mountain Coal Company) elected to participate in this exploration program with Bowie.

Oxbow applied for the Elk Creek Coal Lease Tract as a logical extension to its existing mining. Oxbow presently operates with a longwall system for underground mining at its Sanborn Creek Mine.

The federal coal reserves in this area are comprised of high BTU, low sulfur coal. This high quality coal is sometimes referred to as “clean coal” or “compliance coal.” Industry demand for this coal is relatively high in that its use helps achieve Clean Air Act requirements.

Both the BLM and the Forest Service maintain policies which allow private industry to explore, develop, and mine coal on federal lands. Pursuant to the Mineral Leasing Act of 1920, as amended by the Federal Coal Leasing Amendments Act of 1976, the BLM administers a coal leasing program to allow the private sector to mine federally owned coal reserves. Under the terms of this law, the BLM is charged with the administration of the coal mineral estate on federal lands and is required to lease coal for economic recovery. Consent by the surface management agency (the Forest Service in this case) is required before BLM can proceed with leasing.

S-1.3 Decisions to be Made

The BLM and the Forest Service are the joint lead agencies responsible for completion of this EIS. The Office of Surface Mining Reclamation and Enforcement (OSM) is a cooperating agency on this EIS. These three agencies are following specific procedures that began with scoping and data collection and continued with analysis of data and evaluation of alternatives. In accordance with regulations implementing NEPA (40 CFR 1500), the results of this analysis are documented in the EIS and will form the basis for decisions to be made on the Iron Point and Elk Creek Coal Lease tracts, as well as the Iron Point Exploration License application.

After the close of the Draft EIS review and comment period, the BLM and Forest Service considered comments submitted and responded to those comments in the Final EIS. OSM assisted the BLM and Forest Service with comments pertinent to areas of their jurisdiction and expertise. The BLM and Forest Service considered and responded to these comments by:

- Modifying alternatives;
- Modifying the analysis as presented in the Draft EIS;
- Making corrections for the Final EIS; and,
- Explaining why comments do not warrant further agency response.

Under separate cover from the Final EIS, the BLM and Forest Service will issue Records of Decision regarding their respective decisions on the leasing applications and exploration license. In the Records of Decision, the BLM and Forest Service may decide to:

- Adopt the No-Action Alternative (no leasing and/or exploration license);
- Adopt the Proposed Actions (lease the coal as applied for by the applicants and/or grant the exploration license);
- Adopt an alternative with features of several of the alternatives; or,
- Adopt one of the action alternatives with additional mitigation measures.

The BLM Colorado State Director is the NEPA responsible signatory official for the BLM. The Forest Supervisor of the GMUG is the NEPA responsible official for the Forest Service.

If approved, the leases would be offered by competitive bid. If one or both of the coal leases are issued, no mining or surface development could occur on the tracts until the lessee or operator submits, and receives approval of a permit application package (PAP). Pursuant to a cooperative agreement between the OSM and the Colorado Division of Minerals and Geology (DMG), a federal coal lease holder in Colorado must submit (and receive approval of) a PAP from both the OSM and the Colorado DMG for any proposed coal mining and reclamation operations on lands within Colorado.

S-1.4 Issues and Concerns

Scoping was conducted to focus the EIS on those issues and concerns considered important to the public and various government agencies. A Scoping Summary Document was prepared and made publically available in July 1999.

The issues that are addressed in the EIS are as follows:

- **Air Quality:** Identify and minimize air quality impacts;

- **Aquatic Resources/Fisheries:** Minimize disturbance to fish habitat and fish populations;

- **Cultural Resources:** Identify cultural resources and minimize disturbance impacts to these resources;

- **Cumulative Impacts:** Address the cumulative impacts of leasing and exploration with other potential projects;

- **Geology/Geotechnical Issues/Subsidence:** Identify geologic hazards on the lease sites and the potential for subsidence by underground mining activities;

- **Health/Safety:** Protect worker health and safety;

- **Land Use:** Minimize disturbance;

- **Noise:** Identify and minimize noise impacts;

- **Reclamation:** Provide for reclamation of disturbed areas;

- **Recreation:** Minimize disturbance to recreational opportunities;

- **Socioeconomics:** Address the social and economic impacts on local residents of Delta and Gunnison counties;

- **Surface Water/Groundwater:** Identify and minimize impacts to water quality and hydrology to maintain the integrity of watersheds within and surrounding the lease tract areas. Maintain adequate flows to drainages and ditches above underground mining activities;

- **Transportation:** Address truck and train traffic impacts created by coal mining in the North Fork of the Gunnison Valley and the potential for accidents;
- **Vegetation:** Address the impacts to vegetation as a result of mining and exploration activities;

- **Wetlands:** Identify and minimize impacts to wetlands/riparian areas; and,

- **Wildlife:** Minimize disruption to terrestrial wildlife and wildlife habitats.

S-2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

The discussion of alternatives is the foundation of the EIS process. The BLM and Forest Service have explored and evaluated numerous ideas and options during the selection and development of the alternatives which includes a No-Action Alternative and several Action Alternatives including the plans as submitted by the applicants for the exploration license and the coal lease tracts. In total, four alternatives (including the No-Action Alternative) were developed for evaluation in the EIS.

Alternatives were developed and analyzed to respond to the purpose for and need of the proposed actions, to address social and environmental issues, to respond to public and agency concerns and input, and to satisfy NEPA regulations.

Under the action alternatives considered, the BLM would hold coal lease sales for the Iron Point and Elk Creek Coal Lease tracts, subject to coal lease stipulations of the BLM and the Forest Service, as well as any coal lease stipulations developed as part of the EIS process. It should be noted that the LBA process is, by law, an open, public, competitive, sealed-bid process whereupon the coal lease would be granted to the highest qualified bidder.

S-2.1 Alternative A - No-Action

This alternative assumes no leasing would occur and that the exploration license would be denied. NEPA requires that a "No-Action" alternative be considered in environmental documents. Under the No-Action Alternative, the coal operations would continue operating under the appropriate production levels permitted by the Colorado DMG. For further information, please refer to the response to comment 16-21 in *Appendix O, Public and Agency Participation and Involvement in the Draft EIS*. This appendix is part of the Final EIS.

S-2.2 Alternative B - Proposed Action

This alternative was generated based on the original coal lease applications submitted by Bowie and Oxbow.

The proposed action for the Iron Point Coal Lease Tract assumes a northern boundary south of the Terror Creek Reservoir, along with an area that would provide access under Terror Creek to coal reserves to existing federal coal lease (C-37210) in an area known as the Bowie No. 1 "pod." There would be no subsidence under the Curecanti-Rifle 23/345 kV electric transmission line which essentially is parallel to Terror Creek. Production from the Iron Point Coal Lease Tract was assumed to be 5 million tons per year from the D coal seam via longwall mining techniques.

The Elk Creek Coal Lease Tract would also be mined by longwall techniques. The production on this tract would also be at 5 million tons per year from the D coal seam.

Under Alternative D, the applicant proposed to drill 25 exploration holes. Holes would be rotary drilled to predetermined depths, cased as necessary, and the coal zone would be cored. Since the release of the Draft EIS, the applicant requested shifts on some of the drill hole locations. These proposed relocations were not received in time to analyze in the EIS, or for the public to review and comment on them. However, the EIS examined the broader effects of exploration in the delineated license area, and can be relied upon to assess granting the license and approve specific hole locations originally submitted that were unchanged.

S-2.3 Alternative C - Multiple Seam Mining

This alternative is similar to Alternative B, with the inclusion of additional B seam coal reserves in the Iron Point Coal Lease Tract, as well as additional surface area and reserves that are located between the Iron Point and Elk Creek Coal Lease tracts. An area was also added to the Iron Point Coal Lease Tract in the Terror Creek drainage to facilitate flexibility in locating entries beneath Terror Creek for access to coal in the Bowie No. 1 "pod." In Alternative C, mining would be completed by longwall techniques, and coal production would be the same as outlined in Alternative B.

S-2.4 Alternative D - Subsidence Protection

This alternative would be essentially the same as Alternative C, with the limitation that there would be no subsidence under Terror or Hubbard creeks, or the Curecanti-Rifle 230/345 kV electric transmission line. Based on continuing geologic analysis for the area, since the issuance of the Draft EIS, the boundaries of the proposed Iron Point Coal Lease Tract have been modified. It appears that the B and D coal seams thin and split into seams of unmineable thickness toward the northwest part of the tract. In addition, the continuing analysis indicates that the igneous intrusions may have "burned" portions of the B and D coal seams, leaving no mineable coal. Based on this re-evaluation of the lease tract, there are approximately 5 million tons of coal less in Alternative D than originally estimated in the Draft EIS. The re-alignment of the boundary also provides additional protection to Terror Creek Ditch and Reservoir.

S-2.5 Preferred Alternative

The responsible agencies have identified Alternative D as the a preferred alternative. Alternative D provides for leasing with standard special coal lease stipulations, subsidence protection under perennial drainages, and additional seams and acreage. In particular, the agencies have decided that protection of perennial drainages would be necessary to maintain watershed integrity and ecosystem health, so provisions in Alternative D offer protection for perennial drainages by eliminating subsidence in those areas. Coal recovery for Alternative D would be estimated at approximately 60 million tons for the two lease tracts.

For the Iron Point Coal Exploration License, the preferred Alternative is D with the exceptions addressed in S-2.2, Alternative B - Proposed Action. Alternative B for the exploration license would provide standard and special surface use stipulations to reduce potential surface impacts.

S-3.0 ENVIRONMENTAL ANALYSIS

This section of the EIS describes both the existing conditions of and the environmental consequences to the area and its resources. Resource descriptions focus on areas which would likely be affected by reasonably foreseeable mining and exploration activities.

S-3.1 Air Quality/Climate

Existing Conditions - The air quality and climate in the North Fork of the Gunnison River Valley are influenced by the rugged topography and the prevailing east-southeast winds. The air quality of the region is good.

The mountain valleys on the west side of the Rockies are subject to large ranges in precipitation and temperature conditions. The monthly temperature profiles at Paonia, Colorado show a range from an average daily of 24.9 degrees F in January to an average monthly value of 72.6 degrees F in July. Precipitation ranges from 0.08 inches in June to 1.61 inches in October, with an average annual precipitation at Paonia of 15.17 inches. The prevailing wind direction in the North Fork of the Gunnison River Valley near the community of Somerset is east-southeast. The daily cycle of changing up-valley and down-valley local wind directions is common in western Colorado mountain areas. The strongest winds, presumably associated with passing thunder storms and pre-frontal weather are from the south or southwest.

Environmental Consequences - Due to anticipated increases in coal production from the existing coal mines in the North Fork of the Gunnison River area, emissions from mining operations in the North Fork Valley and coal trains are expected to increase for the No-Action and Action Alternatives; however, any increase in the local emissions of particulate matter and tailpipe exhaust is not expected to cause any impacts to the existing ambient air quality of the region. In addition, any incremental increases in particulate emissions and gaseous emissions resulting from the action alternatives should not cause any observable, detectable or measurable visibility impacts at the West Elk Wilderness Area or at the Black Canyon National Park.

S-3.2 Topography/Physiography

Existing Conditions - The topography of the area within and immediately surrounding the exploration license area and the coal lease tracts ranges from steep to relatively flat. Elevations range from slightly over 5,600 feet in the North Fork of the Gunnison River Valley near the town of Paonia to elevations over 10,000 feet in the mountains surrounding the exploration license and lease tract areas. The topography of the area has been influenced by a wide range of mass-movement land forms and processes at work in the region, including localized natural landslides and rock falls.

Environmental Consequences - Exploration activities as proposed for the Iron Point Exploration License Area would have no noticeable topographic impact.

If the tracts are leased, subsequent underground longwall mining would cause subsidence and physically lower the surface over mined areas. Effects of subsidence would be most noticeable on ridges and steeper slopes, particularly cliffs, where cracks might open on the order of few inches to possibly 1-foot wide and 25 to 50 feet deep. Fewer cracks would occur in the valleys than on ridges, because the valleys are more stable and the alluvial material found in the valleys tends to be more yieldable than some of the brittle bedrock found on the ridges. Subsidence from longwall mining could aggravate the movement of existing landslides and rock falls in areas of moderate to high subsidence potential.

S-3.3 Geology

Existing Conditions - The exploration license area and the coal lease tracts lie in the Paonia-Somerset coal field which contains medium to high coal development potential deposits. The main coal beds within this area are found in the Upper Cretaceous Mesa Verde Formation, which is overlain by the Tertiary Wasatch Formation and underlain by the Upper Cretaceous Mancos Shale. In addition to the exposed sedimentary units, isolated igneous intrusions have been encountered in the project

area. The coal bearing sedimentary strata of the Mesa Verde Formation are relatively flat lying with a regional dip of approximately 5 degrees to the north/northeast. The principal mineable coal seams on the Iron Point Coal Lease Tract are the "D" seam and the "B" seam. The primary mineable coal seam on the Elk Creek Coal Lease Tract is the "D" seam. The overburden overlying the D coal seam in both lease tracts is generally greater than 500 feet and reaches over 2,000 feet in parts of both lease tracts.

Environmental Consequences - There would be negligible effect to the geological resources as a result of drilling activities in the Iron Point Exploration License Area.

If leasing and mining proceeds on the Iron Point and Elk Creek Coal Lease tracts, coal would be removed by longwall mining techniques, and the overlying overburden material would be altered through subsidence. Subsidence would cause a gradual lowering of the surface after the longwall shearer removes the coal. Some cracking would be evident as the shearer passes, and cracking would be also evident along the fringes of the extracted longwall panels. Due to the thickness of the overburden in the two lease tracts, subsidence would not be easily seen by casual observers. The historic (pre-mining) burning of the coal along the outcrop (causing the reddish coloration in the strata in the valley) would preclude a significant amount of mining close to the outcrop; therefore, rock falls induced by subsidence would be unlikely. There is a potential that mining subsidence could aggravate existing landslides in the Hubbard Creek drainage.

Areas with less than 500 feet of overburden cover to the coal seam would show "high to very high" subsidence potential. The potential for subsidence to impact surface resources are lessened with the depth of overburden. Potential subsidence impacts of "low to very low" are typically those areas greater than 1,500 feet of overburden depth to the coal seam.

S-3.4 Soils

Existing Conditions - A total of 32 soil map units, characterized by 38 soil series, families, or miscellaneous groupings, were delineated within and surrounding the lease tracts and exploration license area. These soils are forming in response to a wide variety of parent materials, elevations, slopes, aspects, and rates of material weathering common to the region as a whole.

Environmental Consequences - If exploration and leasing with subsequent mining activities occur, approximately 33.5 acres of surface could be disturbed by the construction of various boreholes, shafts, light-use access roads, and drill pads. Impacts to soils include the salvage and stockpiling of selected soils for later re-application, along with potential compaction and erosion. Given the size and form of the individual facilities comprising the proposed disturbed acreage, as well as regulatory requirements for revegetation, any impacts to soils would be limited and considered to be short-term and mitigable. The disturbance of 33.5 acres amounts to less than 1 percent of the acreages included in the lease tracts and exploration area as a whole.

S-3.5 Surface Water

Existing Conditions - The North Fork of the Gunnison River is located south of the coal lease tracts and exploration license area. Hubbard Creek and Terror Creek drain the Iron Point Exploration License Area and the Iron Point Coal Lease Tract. Hubbard Creek, Bear Creek, and a small portion of Elk Creek drain the Elk Creek Coal Lease Tract. Hubbard, Terror, Bear and Elk creeks are tributaries to the North Fork of the Gunnison River. Hubbard and Terror creeks are perennial drainages in the area. Bear and Elk creeks are ephemeral drainages, flowing only in response to snow melt or severe thunder storms. The surface water quality of Hubbard and Terror creeks and the North Fork of the Gunnison River is calcium bicarbonate type water.

Stream flow in the North Fork of the Gunnison River has been monitored at a US Geological Survey station near the community of Somerset since 1933. The drainage area at the Somerset station is 526 square miles. The highest annual mean flow at this station during the period of record was 829 cubic feet per second (cfs) in 1984. The highest instantaneous peak flow of 9,220 cfs was recorded on May 24, 1984. The lowest annual mean flow for the same station and period of record was 114 cfs in 1997.

Various National Pollutant Discharge Elimination System (NPDES) permits granted to mine operators in the North Fork Valley regulate impacts of current and historic mining on local streams. Monitoring on the North Fork of the Gunnison River shows little impact to the water quality from current or historic mining. Occasional increased concentrations of metals have been observed during periods of increased runoff during the spring. Somewhat elevated sulfate concentrations have been noted in gulches down-drainage of historic mining operations, but these concentrations do not impact the water quality of the North Fork of the Gunnison River.

Environmental Consequences - Potential environmental consequences of leasing (and subsequent mining of) the Iron Point and Elk Creek Coal Lease tracts and granting the Iron Point Exploration License include the following impacts:

- Dewatering of the D coal seam could decrease flow on some sections of Hubbard Creek, which are fed from the D seam;

- Water discharge from mine to surface streams could impact the quality of water in the receiving streams; but mines must comply with terms and conditions of National Pollutant Discharge Elimination System (NPDES) permits, so quality impacts should be minimal.

- Subsidence caused by longwall mining could potentially disrupt stream flows and ponds directly above the underground mining and within the angle of draw. Other impacts could include changes in drainage channel morphology resulting in changes in general surface gradients, which could lead to head cutting, pooling, soil erosion, and sedimentation; and,

- Exploration, construction activities, and use of surface facilities could increase sedimentation; but any exploration and mining activities must comply with the erosion and sediment control standards of the BLM, Forest Service, OSM, and Colorado DMG. Sedimentation impacts should be minimal.

S-3.6 Groundwater

Existing Conditions - The principal groundwater-bearing zones in the North Fork of the Gunnison River Basin occur in Quaternary alluvial and colluvial deposits. Some water also occurs in Cretaceous bedrock.

Alluvial deposits along the North Fork of the Gunnison River represent a major aquifer. The municipal water supply for the town of Paonia is derived from springs in colluvial deposits on the north side of Mt. Lamborn. The water quality of alluvium groundwater is calcium bicarbonate type and good quality. The total dissolved solids (TDS) concentrations of the groundwater range from 43 to 2,300 mg/l with concentrations of sulfate, TDS, and manganese sometimes exceeding federal drinking water standards. Well yields from this zone range from 1 to 150 gpm and average about 20 gpm.

Colluvial water-bearing units located on valley slopes are generally isolated and are limited in extent. These units are normally saturated seasonally and have a low storage capacity and yield. Most springs and seeps in the region issue from colluvial deposits underlain by less permeable bedrock. Seasonal spring discharge from colluvial deposits range from about 0.2 up to 20 gpm, and average about 5 gpm. Colluvial deposits do not represent an aquifer in the region, and no reported wells are

developed in this zone; however, numerous seasonal springs and seeps issue from these zones and have been developed for livestock watering and also support wildlife.

The primary bedrock water-bearing zones in the North Fork of the Gunnison River Basin are in the sandstone and conglomerate units and fractured zones of the Lower Cretaceous Burro Canyon Formation and the Late Cretaceous Dakota Sandstone. Minor groundwater occurrence is reported in the Late Cretaceous Mancos Shale, Mesa Verde and Tertiary Wasatch formations. Well yields from these formations range from about 0.5 to 25 gpm, with a typical average of approximately 10 gpm. Water quality from bedrock wells is generally sodium bicarbonate/sulfate type with TDS concentrations ranging from 490 to 8,200 mg/l, averaging about 2,569 mg/l. Concentrations of sulfate, TDS, manganese, and fluoride typically exceed federal drinking water guidelines.

Past and current mining activities have affected groundwater quantity and quality in the region. For example, mine discharge from the abandoned Oliver Mine and the abandoned Hawk's Nest Mine has somewhat elevated levels of TDS, iron, and manganese. Past and current activities other than mining have also affected groundwater quality. Livestock grazing causes minor impacts to springs and seeps due to erosion, sedimentation, and water quality (i.e., fecal coliform). Unauthorized off-road vehicle use also causes erosion and sedimentation that affect spring and seep areas. Rural septic systems may impact local groundwater quality.

Environmental Consequences - Exploration activities should not noticeably impact groundwater resources. The strata are not uniformly saturated, so there is little concern for inter-strata communication. The drill holes would be small diameter and cause little disturbance to the strata.

Longwall mining of the lease tracts would cause bedrock fracturing and land subsidence above longwall panels. By potentially providing pathways for groundwater to move downward toward the mine horizon, fracturing and subsidence may divert water from saturated horizons and surface water bodies above and adjacent to caved areas. Impacts to groundwater systems may result in a decrease in natural discharge rates from springs and seeps or changes in water levels and yields in area wells.

Mining would dewater the coal horizon and water saturated horizons immediately above and below the coal horizon. Degradation of water quality could occur when groundwater flows through active or abandoned mine workings. Diversion of groundwater resulting from dewatering of the coal seam could also occur as a result of underground mining. Water rights could be affected if area spring flows and associated pond levels are diminished. There is also a potential for increased sedimentation to area springs from construction and use of surface facilities (exploration drill pads and associated access roads).

After mining, mine voids could fill with groundwater. The groundwater would be exposed to collapsed and abandoned mine workings, and the quality of the water may be impacted. The most likely impact would be an increased concentration of TDS, iron, manganese, and possibly sulfate. The groundwater flow direction in the coal seams of the lease tracts is to the northeast, beneath the Grand Mesa. There are no known wells or springs down gradient of the lease tracts that could be affected by any possible groundwater degradation.

S-3.7 Vegetation

Existing Conditions - Eight upland vegetation types were mapped at the reconnaissance level within and surrounding the coal lease tracts and exploration license area. These vegetation types include the following communities:

- Oak
- Aspen

- Pinon/Juniper
- Douglas fir
- Cottonwood
- Spruce/fir
- Grass/forb
- Bare

A number of noxious weed species are known to be of concern in Delta and Gunnison counties. These species include Russian knapweed, hoary cress, yellow toadflax, Canada thistle, musk thistle, and scotch thistle.

No federally listed threatened or endangered plant species are known to exist on either coal lease tract or the exploration license area. A "forest-sensitive" species, Hapman's coolwort, could be present in the Hubbard Falls area.

Environmental Consequences - The construction of various borehole, shaft, and access road facilities would directly affect a maximum of approximately 33.5 acres of vegetation. The primary vegetation communities to be affected include the oak and aspen vegetation types. The resulting loss of any timber or grazing resources would be minimal, with the potential for a slight long-term increase in grazing potential possible following revegetation activities. It is unlikely that any measurable impact to vegetation would occur as a result of mine subsidence.

S-3.8 Wetlands

Existing Conditions - No formal delineations of wetlands or other Waters of the U.S. were completed on either the coal lease tracts or the exploration license area. Seep and spring information was compiled for the coal lease tracts and the exploration area.

Wetland and riparian plant communities, other than those associated with seeps, springs, and stockponds, are typically confined to the borders of creeks and drainage channels. Wetland hydrology is provided primarily by channel flooding and lateral flow. Wetland/upland transition zones are typically narrow to abrupt as a function of channel topography. Wetland vegetation communities are comparatively simplistic in terms of diversity, typically being dominated by a few hydric species. The tree stratum, where it occurs, is dominated by narrow-leaf cottonwood and boxelder at lower elevations. Aspen is the common tree of wetlands occurring at higher elevations. Dominant wetland shrubs include a variety of species such as coyote willow and plane-leaf willow, thinleaf alder, and red-osier dogwood.

Springs and seeps in the region typically support willows along with a variety of grasses and forbs. Springs and seeps on nearly level to moderate terrain, particularly at higher elevations, support herbaceous communities characterized by species such as California false-hellebore, streamside bluebells, and various sedges. Stockponds are man-made features which are filled either by springs or from overland runoff. Wetlands occurring in association with developed stockponds are typically limited to a narrow bank fringe, dominated primarily by spikerush and rush species. Other species such as small-winged sedge, clustered field sedge, northwest cinquefoil, and a variety of butter-cups may also be present.

Environmental Consequences - Impacts, which would vary by action alternative, are directly associated with potential subsidence and possible dewatering in Hubbard and Terror creeks.

With dewatering of the D coal seam during operations, some wetlands along Hubbard Creek could be affected. Depending upon the size of the reduction, the wetland/riparian area boundary zones might shrink along the margins of Hubbard Creek. Dominant wetland herbaceous species inhabiting this

zone and requiring saturated soils throughout the growing season would likely be replaced, in part, by wetland or upland plants adapted to less hydric soil moisture regimes. Following cessation of underground mining activities, the abandoned workings would fill with water and be expected to recover to approximate conditions that existed prior to mining. When this occurs, spring and seep conditions would be expected to return to Hubbard Creek near the vicinity of the D coal seam subcrop. With the return of seep and spring flows, the wetlands of Hubbard Creek near the D coal seam subcrop would essentially revert to their pre-mining condition in terms of extent and overall function, diversity, and productivity.

S-3.9 Terrestrial Wildlife

Existing Conditions - The lease tract and exploration license areas occur within Colorado Division of Wildlife Game Management Unit 521. Mule deer, elk, black bear, and mountain lion occur within this area. Mule deer and elk populations within the area exhibit seasonal movements to and from higher to lower elevation habitats in response to weather patterns and snow cover.

Habitat for water birds is restricted primarily to the North Fork of the Gunnison River, although there is some water bird habitat associated with Hubbard Creek, Terror Creek, and Terror Creek Reservoir. Use of the area for resting, feeding, or nesting by water birds is limited primarily to puddle ducks (such as mallard and teal), spotted sandpiper, and killdeer.

Several species of raptors are known to occur and nest within the region. These include turkey vulture, northern harrier, golden eagle, Cooper's hawk, sharp-skinned hawk, red-tailed hawk, prairie falcon, American kestrel, western screech owl, great horned owl, northern pigmy owl, long-eared owl, and northern saw-whet owl. Nest site preferences of raptors vary considerably, ranging from relatively large trees with open crowns or on cliff ledges and areas of rock outcrop. Nesting by a pair of golden eagles has been documented by the Forest Service in upper Hubbard Creek Canyon.

A variety of songbird and similar species reside within the region. The majority of these species migrate south or to lower elevations for wintering months, and only a few species remain in the region during winter months. Woodpeckers, jays, chickadees, nuthatches, and finches are representative year-round residents.

No identified critical habitat for any state or federally listed threatened or endangered species has been identified within or immediately surrounding the coal lease tracts or exploration license area. The bald eagle is present as a winter resident along the North Fork of the Gunnison River drainage. This drainage and adjacent habitats are designated as a winter concentration area and winter range for bald eagles, by the Colorado Division of Wildlife. There is also potential for tiger salamander and boreal toad to exist in wetland and riparian habitats, particularly along Hubbard Creek.

Environmental Consequences - The construction of various borehole, shaft, and access road facilities would create approximately 33.5 acres of new surface disturbance in currently undisturbed areas of vegetation communities and wildlife habitats. The principal wildlife habitats to be affected would be oak brush and aspen habitats. Potential effects to species of concern are greatest with loss of aspen, Douglas fir, and cottonwood habitats, but most of these impacts can be avoided with the implementation of appropriate mitigation measures.

There would be road activity associated with the proposed exploration of the Iron Point area. This would include construction of approximately 3 miles of new temporary road and 4 miles of light reconstruction. In addition, there is a possibility of approximately 3 miles of new road construction within the Iron Point Coal Lease Tract on Forest Service lands to access proposed degasification boreholes. Potential impacts to deer and elk due to road construction and reconstruction would result from an increase in motorized travel in areas where none previously existed. This would also cause a

decrease in the habitat effectiveness of the area for deer and elk. Obliteration and reclamation of new temporary roads would restore habitat effectiveness.

Impacts to wetlands and riparian habitat, as well as to potential breeding habitat for boreal toad and tiger salamander, would occur if there was construction of a drill site access road along Hubbard Creek. However, there is a Forest Service stipulation that precludes road and pad construction in riparian areas or wetlands.

Other impacts to terrestrial wildlife might include the surface effects of subsidence (mainly the creation of surface cracks), a potential increase in train and vehicle collisions with wintering mule deer and elk, and potential changes in bald eagle winter habitat resulting from any flow reductions in the North Fork of the Gunnison River.

S-3.10 Aquatic Resources/Fisheries

Existing Conditions - The main section of the North Fork of the Gunnison River is classified as a Class I cold water aquatic life by the Colorado Department of Public Health and Environment. This classification is defined as "...waters that (1) currently are capable of sustaining a wide variety of cold water biota, including sensitive species, or (2) could sustain such biota but for correctable water quality conditions."

Game fish species present in the river include rainbow trout, brown trout, cutthroat trout, and brook trout. Rainbow, brown, and cutthroat trout were stocked in the river from 1973 through 1995. Other game fish species such as northern pike and green sunfish sporadically occur in low numbers in the river; these species likely originate from Paonia Reservoir.

Hubbard and Terror creeks support limited trout populations. Trout and native fish species also occur seasonally in the Terror Creek Reservoir and in irrigation ditches; however, drawdown in the Terror Creek Reservoir in the summer restricts year-round habitat for fish. Elk and Bear creeks do not contain game fish species.

Four federally endangered fish species occur in river segments located downstream of the coal lease tracts. These include the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail. The Colorado pikeminnow and razorback sucker presently occur in the Gunnison River. The occurrence of humpback chub is limited to one known recent record in the Gunnison River (1993). No bonytail have been collected in the Gunnison River; this species occurs in the Colorado River and is considered to be the rarest of the four Colorado federally endangered fish species.

Environmental Consequences - Short-term, local increases in turbidity and suspended sediments could occur during exploration activities adjacent to Hubbard Creek and Terror Creek if access roads are constructed. These short-term increases in sediment yield could result in short-term affects on aquatic species and their habitat. Sediment concentrations would stabilize and return to typical background concentrations after exploration activities are completed. By implementing proper drainage and detention structures, the impact of increased sediment levels on aquatic species and their habitat would be low. Any localized increases in sediment would not affect downstream areas in the Gunnison and Colorado rivers that are inhabited by the four federally endangered fish species.

The use of water for mining activities, dust control, and domestic purposes would result in a relatively small depletion of water from Terror Creek, Hubbard Creek, and the North Fork of the Gunnison River. The estimated withdrawal of water would result in total reductions of less than 1 cfs. This depletion would represent a relatively small reduction in habitat for aquatic species. This depletion would be negligible to sections of the Gunnison and Colorado rivers that are inhabited by the four federally endangered fish species.

Mining operations on both coal leases could result in increased discharges to the North Fork of the Gunnison River. However, since all discharges must meet federal and Colorado Department of Public Health and Environment regulations, no adverse affects on aquatic species are anticipated due to the quality of discharged water.

The use and transport of fuels to the exploration sites and mining operations would represent a risk to aquatic species and their habitat, if a spill or accident occurred. By implementing a mitigation measure that would restrict any fueling of vehicles or equipment near streams, water bodies and their associated biological communities would be protected. The risk of a fuel spill or leak reaching the North Fork of the Gunnison River, Hubbard Creek, or Terror Creek during transport is considered extremely low, based on the expected low frequency of such traffic.

S-3.11 Cultural Resources

Existing Conditions - Cultural resource surveys within and surrounding the coal lease tracts and exploration license area revealed 17 sites. These sites have been recorded with the State Historic Preservation Office. Most of these sites are located near the extreme western periphery of the area, generally along the east side of the Terror Creek drainage. This distribution apparently reflects previous survey activity in this area, and is not necessarily indicative of a similar cultural resource distributional pattern within the unsurveyed portions of the area. The sites previously recorded consist of eight isolated prehistoric lithic artifacts, three prehistoric open camp sites, two historic corrals, one historic dugout, one historic dump site, one historic cabin, and one non-cultural rock overhang recorded as a “possible” prehistoric rockshelter.

Historic mining has occurred within and adjacent to the coal lease tracts and exploration license area. The historic King Mine site and the associated Bowie town site, have extensive histories dating from the turn of the century era. Both the King Mine and the Bowie town site have been officially determined eligible for the National Register of Historic Places. Both of these sites, however, are outside of the coal lease tracts and exploration license area.

Environmental Consequences - Cultural site density is low, and no impacts to cultural resources are anticipated. Subsidence as a result of longwall mining should not cause any discernable impacts to cultural resources on the site. Recordation and evaluation of the Dove Cave site is required if it is subject to any future surface impacts including potential subsidence.

S-3.12 Noise

Existing Conditions - Background noise level measurements at representative locations around the project site were taken on April 21 and April 23, 1999. Rural background measurements were taken during the daytime and nighttime at two locations on Garvin Mesa and at one location next to State Highway 133. Daytime and nighttime background noise readings were also taken at several locations in Paonia and Hotchkiss. Some of the monitoring stations at Paonia and Hotchkiss were later used to measure noise levels caused by passing coal trains.

In general, the background noise measurements taken at night on Garvin Mesa were 36 dBA, with the predominant noises being natural bird sounds. Routine daytime noise levels in the urban residential areas were 48 to 56 dBA, with the predominant sounds produced by routine local traffic. At the rural site near State Highway 133, the spot check measurements showed 41 to 49 dBA during brief periods of no discernable traffic and spot noise levels of 64 dBA during the brief period while a coal truck drove past.

Environmental Consequences - Noise has historically been recognized as a health hazard with the potential for causing hearing damage. Efforts by industry and regulatory actions have lessened the

likelihood for hearing damage occurrence. A secondary impact assessment associated with noise is the nuisance effects of noise that include interference with speech, psychologically unsettling environment at home and work, and more specific problems such as sleep disruption. The extent of these effects varies, sometime significantly between individuals and as a factor of the noise source.

Exploration drilling in the Iron Point Exploration License would generate some noise; however, this noise would not create any nuisances to the nearest homes in the North Fork Valley or to the towns of Paonia or Somerset. Noise impacts would also be of limited duration.

The noise emissions as a result of the operation of the surface facilities for the underground mines are not expected to be a general nuisance to nearby towns and residents. The major noise nuisances associated with these mines would result from truck and railroad transportation of coal. These impacts are expected to occur on a more frequent basis with future coal production increasing from 1998 levels to the presently permitted coal production rates for valley mines. Under certain meteorological conditions with quiet background, it is possible that noise from the surface facilities of the Bowie No. 2 Mine could be audible and perceived as a nuisance at Garvin Mesa, approximately 2 miles west of the surface facilities.

Coal truck traffic on State Highway 133 can cause noise impacts to homes within 200 feet of the highway. Within 100 feet of the highway right-of-way, homes would experience a severe impact. Such noise levels would be more predominant at nighttime, when background noise levels are lower.

Noise measurements showed that train noise (excluding whistles) varied considerably depending on the speed of the train, the distance from the track, and the presence of buildings between the tracks and the receiver. Generally, noise from a fast-moving train would be much higher than noise from a slow-moving train.

Federal train safety laws require trains crossing public roads to sound their whistles at least once within a quarter mile of each public grade crossing. Whistles blown an estimated 100 feet from the public crossing would be expected to exceed noise levels of 100 dBA.

Although the noise from passing trains would be audible during quiet nighttime periods, the noise of passing trains (excluding whistles) would not be expected to disrupt sleep or normal speech of individuals living more than two blocks from the railroad tracks under most conditions.

S-3.13 Land Use

Existing Conditions - Land uses within the region are mining, grazing, agriculture, logging, residential development, and dispersed recreation.

There is a mixture of federal and private lands within the two coal lease tracts and the exploration license area, as follows:

- Forest Service - 59%
- BLM - 26%
- Private - 15%

All coal within the two coal lease tracts and the coal exploration license area is federally controlled.

Environmental Consequences - In the long-term, following mining, the area within and surrounding the coal lease tracts would be used much as it was before any mining. Any surface subsidence caused by underground mining would be minimal and would not affect the pre-mining land use. The

reclamation and revegetation techniques to be undertaken on any disturbed sites are comparatively simplistic, commonly accepted techniques with a history of successful application in the western states.

S-3.14 Transportation

Existing Conditions - The major transportation route servicing the Paonia-Somerset area is State Highway 133. This highway serves local residents and associated commercial traffic for the local communities, including the mining operations in the North Fork Valley. State Highway 133 is an asphalt, all-weather, two lane highway, that joins the community of Carbondale with the town of Hotchkiss.

Highway traffic counts are identified as annual average daily traffic (ADT). ADT is defined as the measure of traffic over a 24-hour period and is determined by counting the number of vehicles passing a specific point in either direction. The Colorado Department of Transportation has estimated annual 1996 ADT values based on actual traffic counts made at various locations along State Highway 133. The 1996 ADT values on State Highway 133 just east of Paonia is 3,150. At Somerset, the ADT for State Highway 133 was 2,000 in 1996.

The mines in the North Fork of the Gunnison River Valley are accessed by a railroad spur that connects a main Union Pacific Railroad line in Grand Junction, Colorado with the mining operations. This spur line is known as the North Fork Branch and is approximately 95.5 miles in length. The railroad passes through the communities of Delta, Hotchkiss, Paonia, and Somerset. In 1998, 850 coal trains utilized the North Fork Branch. This translates to an average of 2.5 trains per day. An estimated 8.6 million tons of coal were shipped in 1998.

Environmental Consequences - Increases in traffic on State Highway 133 as a result of exploration activities in the Iron Point Exploration License area would be very minor and probably not noticeable. The magnitude of effects associated with rail and highway traffic related activities from mining operations would depend on the amount of coal produced and sold from the mines.

As coal production at the Bowie No. 2 Mine is increased from 1.2 million tons in 1998 to a projected 5 million tons in 2000, coal truck ADT on State Highway 133 between the Bowie No. 2 Mine and the Bowie No. 1 Loadout would increase from 234 to 978, a 400 percent increase. In 1998, the coal truck traffic from the Bowie No. 2 Mine represented approximately 7 percent of the traffic on State Highway 133 between the mine and the loadout. If production is increased to 5 million tons per year in the year 2000 and beyond, the coal truck traffic would represent approximately 21 to 22 percent of the total traffic on that stretch of State Highway 133 between the mine and the loadout. Other than coal traffic, general exploration and mine related traffic would involve only a very minor increase to ADT levels on State Highway 133 between Paonia and Somerset.

Projections call for coal production to increase from the North Fork Valley coal mines from 1998 to 2005. This production increase would relate to additional train traffic on the North Fork Branch. If production increases to 19.2 million tons in 2005, there would be an average of ten trains per day (five loaded and five empty) on the rail line. In 1998, with 8.6 million tons of coal shipped on the Union Pacific Railroad from the North Fork mines, it is estimated the average interval between trains was 5 hours and 27 minutes. If coal production increases to 18.2 million tons in the year 2005, the average interval between trains would be 2 hours and 24 minutes.

With the projected increase in daily traffic, particularly the increase in coal truck traffic from the Bowie No. 2 Mine to the Bowie No. 1 Loadout, it is reasonable to assume that accidents could increase over the life of any mining activities. With the projected increase in daily coal train traffic, the potential for highway vehicles and train accidents at rail crossings would also increase. Delays at train crossings could also have impact on public safety. Delays could also affect local businesses such as those near

the State Highway 50 crossing in Delta. Ambulance service, as well as police and fire response times, would be delayed an estimated 5 to 7 minutes when crossings are blocked by passing trains.

S-3.15 Socioeconomics

Existing Conditions - As of 1998, approximately 26,600 residents live in Delta County and 12,475 residents live in Gunnison County. Population in both counties is forecast to increase at an annual rate of just over 2 percent for the next 20+ years.

Both Delta and Gunnison counties have experienced substantial job growth in recent years, though mining activity is a smaller proportion of the employment base. The mines in the North Fork Valley have restructured to achieve substantially greater productivity in a more competitive domestic and global market.

The primary study area is served by two ambulance districts, five fire districts, municipal police, and county sheriff services. Municipal water service is available in all incorporated communities of Delta County, and municipal sewage/waste water treatment is available in all incorporated jurisdictions except Orchard City. Electric service is available in Delta and Gunnison counties through Tri-State Generation and Transmission Association and its local affiliates: Delta-Montrose Electric Association and Gunnison Electric Association.

Medical services are provided through Delta Hospital, which is a full service, general acute care hospital. This hospital has 49 beds, home health care, a staff of 28 doctors, and 198 full-time and 89 part-time employees.

The federal government receives royalties from mining of federal coal. The state of Colorado receives tax revenues primarily from sales, severance, and income taxes as well as 50 percent of the royalties from mining federal coal. Local governmental entities receive property, sales, and severance taxes, as well as a share of the federal royalties.

The state of Colorado and local jurisdictions in Delta and Gunnison counties currently receive an estimated $11.4 million in combined annual tax revenue related to operation of the Bowie No. 2 and Oxbow mines and mine-related employees. Of this amount, 52 percent accrues to the state government and 48 percent to the local governments in Delta and Gunnison counties.

Communities along the North Fork of the Gunnison River have a long history with coal mining extending back to the late 1880s. Over 60 percent of the households in Delta County are identified with demographic and lifestyle characteristics of “rustic living.” These households tend to remain actively involved in making a living from the land, including agriculture, mining and construction. Whether or not coal mining is viewed as having a positive or negative effect on the quality of life depends on values that receive greatest emphasis from different residents of the North Fork region, and in part on resident dependence on natural resource related industries.

Environmental Consequences - Socioeconomic effects of the No-Action Alternative would occur due to a reduction in coal mine activities within the region. Under the No-Action Alternative, mining of reserves at existing mines would continue at current extraction rates until reserves are completed.

If both mines ceased operations, more than 800 residents would be directly affected. Whether these people would remain in the area would depend on whether people chose to relocate elsewhere to find employment or remain in the local study area. Combined, these two mine closures could affect nearly 2,380 residents living in the local study area.

Under the No-Action Alternative, community and public service providers would be affected by a combination of direct and indirect effects. If not offset by alternative sources of revenue, the level of service available from existing providers could decline. With cessation of the Bowie and Oxbow operations, the state of Colorado and local jurisdictions in Delta and Gunnison counties could lose an estimated $11.4 million in combined annual tax revenue. In addition, local government would lose a portion of the following estimated annual revenues resulting from closures of the Bowie and Oxbow operations: $5.7 million in federal royalties, $2.1 million in state severance tax, and $1.8 million in state sales tax.

With the implementation of any of the action alternatives (B, C, and/or D), there would be no significant changes in mine employment and the socioeconomic effects would be viewed as a continuation of existing effects. The action alternatives (B, C, and D) would allow continued mining for a period of approximately 5 to 8 years beyond what is expected with the No-Action Alternative. It is also conceivable that the life of North Fork mines could be extended further if operators successfully secure unmined seams on private lands or added federal leases.

During any production from the Iron Point and Elk Creek Coal Lease tracts, state of Colorado and local jurisdictions in Delta and Gunnison counties would receive approximately $13.5 million annually in tax revenues. In addition, mining on the two lease tracts could generate an estimated income of $6.7 million in federal royalties, $2.4 million in state severance taxes, and $1.8 million in state sales tax and royalties. Taxes could fluctuate year-to-year.

Tax revenues and royalties would continue for the life of any mining. Upon project closure and reclamation, employment would be lost, directly and indirectly affecting the local communities in the North Fork Valley. In addition, tax and royalty revenues would cease. Other impacts would be similar to those described for the No-Action Alternative.

Table S-1
Summary of Impacts by Alternative for Each Issue

Issue/Concern	Alternative			
	A	B	C	D
AIR QUALITY				
Effects from Fugitive Dust	None-no mining from lease tracts or exploration	Low	Low	Low
Effects from Gaseous Emissions	None-no mining from lease tracts or exploration	Low	Low	Low
Visibility Effects on West Elk Wilderness Area	None-no mining from lease tracts or exploration	Low - Moderate	Low - Moderate	Low - Moderate
Visibility Effects on Black Canyon National Park	None-no mining from lease tracts or exploration	Negligible	Negligible	Negligible
AQUATIC RESOURCES/FISHERIES				
Direct Disturbance to Stream Channels	None-no mining from lease tracts or exploration	Moderate-High	Moderate-High	Low
Reduced Flow	None-no mining from lease tracts or exploration	Low-Moderate	Low-Moderate	Low

Table S-1
Summary of Impacts by Alternative for Each Issue

Issue/Concern	Alternative			
	A	B	C	D
Stream Sedimentation	None-no mining from lease tracts or exploration	Low-Moderate	Low-Moderate	Low
Water Quality Degradation	None-no mining from lease tracts or exploration	Low	Low	Low
Impacts to Threatened and Endangered Aquatic Species	None-no mining from lease tracts or exploration	Negligible	Negligible	Negligible
CULTURAL RESOURCES				
Impact to Cultural and Historic Sites	None-no mining from lease tracts or exploration	Low	Low	Low
GEOLOGY/SUBSIDENCE				
Potential Effect to Curecanti-Rifle 230/345 kV Electric Transmission Line	None-no mining from lease tracts or exploration	None	None	None
Potential Effect to Terror Creek Reservoir	None-no mining from lease tracts or exploration	Low	Low	Low
Potential Effect to Terror Creek	None-no mining from lease tracts or exploration	Moderate	Moderate	Negligible
Potential Effect to Hubbard Creek	None-no mining from lease tracts or exploration	Moderate	Moderate	Negligible
Potential to Aggravate Landslides	None-no mining from lease tracts or exploration	Low	Low	Low
Land Use				
Acres Disturbed (total)	Not Applicable to lease tracts or exploration	33.5	33.5	33.5
Land Disturbed by Ownership (%)	Not Applicable to lease tracts			
▸ BLM		26	27	27
▸ Forest Service		59	62	62
▸ Private		15	11	11
Noise*				
Noise Effects From Surface Facilities	Low - Moderate	Low - Moderate	Low - Moderate	Low - Moderate
Noise Effects From Coal Trucks	Low - High	Low - High	Low - High	Low - High
Noise Effects From Coal Trains	Moderate - High	Moderate - High	Moderate - High	Moderate - High

* Noise effects vary based on distance from the noise source.

Table S-1
Summary of Impacts by Alternative for Each Issue

Issue/Concern	Alternative			
	A	B	C	D
Recreation				
Disruption to Recreational Opportunities in Undeveloped Areas	Not Applicable to lease tracts	Negligible	Negligible	Negligible
Changes in Recreational Access to Undeveloped Areas	Not Applicable to lease tracts	Negligible	Negligible	Negligible
Socioeconomics				
Projected Total Life of Mining ▸ Iron Point Tract ▸ Elk Creek Tract	 1.5* 3*	 5 5	 8 6	 7.5 6
* Remaining permitted life of Bowie No. 2 and Sanborn Creek mines under No-Action Alternative.				
Annual Employment During Mining ▸ Iron Point Tract ▸ Elk Creek Tract	 157** 215**	 168 215	 168 215	 168 215
** Current employment levels at Bowie No. 2 and Sanborn Creek mines.				
Projected Multi-Year Tax Revenues for Mining of Iron Point and Elk Creek tracts (direct + indirect)	0	$88,500,000	$123,900,00	$119,475,000
Projected Federal Coal Royalties From Mining Iron Point and Elk Creek tracts	0	$35,500,000	$46,900,000	$45,225,000
Surface and Groundwater				
Changes in Surface and Groundwater Chemistry	Not Applicable to lease tracts	Low	Low	Low
Potential Impact to Terror Creek Reservoir	None	Low	Low	Low
Potential to Alter Downstream Flow Rates	Not Applicable to lease tracts	Moderate	Moderate	Low
Transportation				
Average Number of Round Trips per Day for North Fork Branch Railroad (Cumulative)	4.4 @ 8.6 million tons per year	10 @ 19.2 million tons per year	10 @ 19.2 million tons per year	10 @ 19.2 million tons per year
Average Number of Round trips per Day for Coal Truck haulage Between Bowie No. 2 Mine and Bowie No. 1 Loadout	978 @ 5 million tons per year production	978 @ 5 million tons per year production	978 @ 5 million tons per year production	978 @ 5 million tons per year production
Potential for Accidents at Railroad Crossings	Low	Low	Low	Low
Potential for Accidents on State Highway 133 Due to Coal Truck Haulage	Moderate	Moderate	Moderate	Moderate

Table S-1
Summary of Impacts by Alternative for Each Issue

Issue/Concern	Alternative			
	A	B	C	D
Potential for Accidents by Using Private Haul Road, Conveyor or by Moving Bowie No. 1 Loadout	Low	Low	Low	Low
Vegetation				
Number of Threatened and Endangered Plants Lost	None-no mining from lease tracts or exploration	0	0	0
Potential Impact of Noxious Weeds	None-no mining from lease tracts or exploration	Low	Low	Low
Potential Impact to Sensitive Plants	None-no mining from lease tracts or exploration	Low to Moderate	Low to Moderate	Negligible
Wetlands				
Potential to Impact Wetlands/Riparian Zones				
▸ Terror Creek	None-no mining from lease tracts or exploration	Low	Low	Negligible
▸ Hubbard Creek	None-no mining from lease tracts or exploration	Low	Low	Negligible
Wildlife (Terrestrial)				
Impacts to Threatened and Endangered Terrestrial Wildlife Species	None-no mining from lease tracts or exploration	Low	Low	Very Low
Impacts to Deer/Elk Habitat	None-no mining from lease tracts or exploration	Negligible - Low	Negligible - Low	Negligible - Low

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Chapter 1

Purpose and Need for Action

1.0 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

This Environmental Impact Statement (EIS) considers three proposed actions involving federal coal lands, and is a joint document between the United States Department of the Interior (USDI), Colorado State Office, Bureau of Land Management (BLM) and the United States Department of Agriculture (USDA), Forest Service, Grand Mesa-Uncompahgre-Gunnison National Forests (GMUG). The USDI, Office of Surface Mining Reclamation and Enforcement (OSM), Western Regional Coordinating Center is participating as a cooperating agency. The three actions include two lease-by-applications (LBA), and a request for an exploration license which were filed with the BLM under provisions found in 43 CFR 3400.

The locations of the two LBA tracts and the exploration license area are shown in *Figure 1, General Location Map*. The lands involved encompass public lands in the BLM Uncompahgre Basin Resource Area, and National Forest System lands administered by the GMUG. The west tract is known as the Iron Point Tract. The BLM assigned this tract serial number COC-61209. The LBA tract to the east is known as the Elk Creek Tract and was assigned serial number COC-61357. The exploration area is within and north of the Iron Point Coal Lease Tract and was assigned serial number COC-61945.

This EIS documents the environmental analysis of the proposed decisions regarding the possible offering of the two federal coal lease tracts and the approval or denial of an exploration license in accordance with the National Environmental Policy Act (NEPA). The EIS process provides a forum for public review and comment on the two LBA tracts and the exploration license area, with their associated relevant issues and the environmental analysis. This document has been assembled to disclose the potential impacts and to provide the decision-makers with information needed to make decisions that are informed and relevant to the specifics of the LBA and exploration license submittals. This EIS also documents the process used to analyze the submittals and alternatives to the requests, the environmental impacts, and possible mitigation measures to be included as stipulations in the event the leases are issued and the exploration license is approved.

1.2 BACKGROUND

Coal was originally discovered along the North Fork of the Gunnison River in the late 1880's, and underground coal mining has occurred subsequently in this area for the past 100 years. Bowie Resources Ltd. (Bowie), Oxbow Mining Inc. (Oxbow) and Mountain Coal Company (Mountain Coal) currently operate underground coal mines in this area.

In August of 1997, Bowie filed a coal lease application with the BLM for a tract designated as the Iron Point Coal Lease Tract (COC-61209). This tract covers approximately 3,403 acres of federal coal in Delta County, Colorado, and is shown on *Figure 1, General Location Map*. The Iron Point Tract contains a mixture of federal (BLM and Forest Service) and private surface ownership. See *Figure 2, Surface Ownership Map*. Details regarding the Iron Point Tract are set forth in *Appendix A, Lease Tract Information*. This appendix contains the legal description and estimated reserves of the Iron Point Coal Lease Tract.

In November of 1997, Oxbow filed a lease application with the BLM for approximately 3,703 acres of federal coal in Delta and Gunnison counties, Colorado. This tract was designated the Elk Creek Tract (COC-61357) by the BLM. Oxbow's lease application was amended by the BLM, during tract delineation, to include an additional 160 acres in Section 32, Township 12 South, Range 90 West. The additional area was incorporated into the Elk Creek Tract to ensure that federal coal for which there

was adequate coal data was included to avoid a potential future bypass of coal. As comments on the Draft EIS, Oxbow requested that the eastern boundary of the Elk Creek Tract be straightened. This revision is displayed in Alternative D of the Final EIS. The additional area is minor and has been previously covered in the analysis work completed as part of the EIS process. The tract, as amended, now covers approximately 3,863 acres and is shown on *Figure 1, General Location Map*. This tract contains a mixture of both federal (BLM and Forest Service) and private surface ownership. See *Figure 2, Surface Ownership Map*. Oxbow owns some of the surface and has obtained rights from other surface owners to access the private land. The legal description and estimated reserves for the Elk Creek Coal Lease Tract are set forth in *Appendix A, Lease Tract Information*.

In May of 1998, Bowie submitted an application for a coal exploration license (COC-61945) on unleased lands within and adjacent to the Iron Point Coal Lease Tract. The exploration license area contains approximately 6,053 acres and is shown on *Figure 1, General Location Map*. Most of the surface included in the coal exploration license application is managed by the Forest Service. As comments on the Draft EIS, Bowie requested a slight relocation of several of the exploration drill holes proposed for the exploration license area.

There is a total of approximately 11,700 acres in the project area. Surface ownership of this area is approximately 59 percent Forest Service, 26 percent BLM, and 15 percent private. See *Figure 2, Surface Ownership Map*. All of the coal estate is federally administered.

Separate environmental assessments (EA) were prepared on the two lease tract applications (as amended by BLM's tract delineation), but not on the requested exploration license. In January of 1999, as part of the NEPA public process, the BLM and the Forest Service determined that the requirements of NEPA would be best served by preparing a consolidated EIS for the two coal lease tracts and the exploration license area.

A Draft EIS on the two lease tract applications and the exploration license area was made available to the U.S. Environmental Protection Agency (EPA) and the general public on September 3, 1999, and a Notice of Availability for the Draft EIS was published in the Federal Register on that same date. The formal comment period on the Draft EIS ended on November 3, 1999.

1.2.1 Iron Point Exploration License (COC-61945)

An exploration license plan has been submitted to the BLM in accordance with 43 CFR 3410.2-1. The legal description for the coal exploration area is set forth in *Appendix A, Lease Tract Information*. Exploration licenses can be granted for the exploration of unleased federal coal deposits. Pursuant to the Mineral Leasing Act of 1920 (MLA), as amended, and to 43 CFR 3410, interested parties can participate with the original applicant in a program for the exploration of unleased federal coal. Any party electing to participate in an exploration license program must share all costs on a pro rata basis with the applicant and with any other party or parties who elect to participate.

In June of 1998, the BLM published a Notice of Invitation in the Delta County Independent in accordance with 43 CFR 3410.2-1(c)(1) describing the exploration license plan area and inviting any parties who are interested to participate in the exploration program. Bowie was the original applicant. Ark Land Company (an affiliate of Mountain Coal Company) has elected to participate in this exploration program.

1.2.2 Iron Point Coal Lease Tract (COC-61209)

Bowie has filed an LBA with the Colorado State Office of the BLM to obtain a federal coal lease pursuant to provisions found at 43 CFR 3425.1. This lease tract has been designated as COC-61209. As applied for, lease tract COC-61209, also identified as the Iron Point Coal Lease Tract, contains

approximately 3,403 acres from which D coal seam reserves would be extracted. The legal description for the Iron Point Coal Lease Tract is set forth in *Appendix A, Lease Tract Information.*

1.2.3 Elk Creek Coal Lease Tract (COC-61357)

Oxbow has filed an LBA with the Colorado State Office of the BLM to obtain a federal lease pursuant to provisions found at 43 CFR 3425.1. This lease tract has been designated as COC-61357. As originally applied for and later amended by the BLM, Lease Tract COC-61357, also identified as the Elk Creek Coal Lease Tract, contains approximately 3,863 acres from which D coal seam reserves would be extracted. The legal description for the Elk Creek Coal Lease Tract is set forth in *Appendix A, Lease Tract Information.*

1.3 PURPOSE AND NEED

The purpose and need for this EIS is to respond to LBA applications and an exploration license application submitted by Bowie and Oxbow. The applicants' purpose and objectives for the LBA tracts are to obtain leases that would allow access to adjacent coal reserves, provide return to their investors, and allow continued coal extraction consistent with applicable company, state, federal, and local environmental permitting and operational requirements. In addition, the purpose and objective for the exploration license area is to determine the extent and viability of federal coal reserves.

Bowie requested the Iron Point Coal Lease Tract in order to obtain reserves to supply potential customers and in order to economically justify the installation of a longwall system. Federal coal deposits in the Iron Point Coal Lease Tract are a logical extension to existing operations at the Bowie No. 2 Mine.

Bowie has also filed for an exploration license in order to obtain additional information regarding coal resources within the Iron Point Coal Lease Tract and areas to the north. Such exploration is required to further delineate the extent of the coal resources in this area, as well as to obtain coal quality information.

Oxbow applied for the Elk Creek Coal Lease Tract as a logical extension to its existing mining. Oxbow presently operates with a longwall system of underground mining. Although mining at the Sanborn Creek Mine was curtailed for the first half of 1999 due to a fire in the mine, Oxbow has recently reinitiated mining operations. Acquisition of the Elk Creek Coal Lease Tract would be a logical future extension of current mining by Oxbow.

The coal mined in the North Fork Valley is a high BTU, low sulphur coal. It is considered a "clean coal" (compliance coal). Its use in industry helps meet standards of the Clean Air Act. As such, there is a demand for coal from the North Fork Valley by the electric power generation industry.

This EIS is prepared to inform federal agency decision-makers, publically disclose the probable environmental impacts of coal leasing and exploration, present a range of reasonable alternatives, and provide for possible mitigation measures in the event the leases and exploration license are approved.

Pursuant to the MLA, as amended by the Federal Coal Leasing Amendments Act of 1976, the BLM administers a coal leasing program to allow the private sector to mine federally owned coal reserves.

Under the terms of this law, the BLM is charged with the administration of the coal mineral estate on federal lands and is required to lease coal for economic recovery. Consent by the surface management agency (in this case the Forest Service) is required before BLM can proceed with leasing.

The Mining and Minerals Policy Act of 1970 states in part that it is the "continuing policy of the federal government in the national interest to foster and encourage private enterprise in...(t)he development of economically sound and stable domestic mining minerals and mineral reclamation industries, ...(and) the orderly and economic development of domestic mineral resources..."

The Federal Land Policy and Management Act of 1976 specifies that public lands are to be managed in a manner that recognizes the need for domestic source of minerals.

The Multiple-Use Sustained Yield Act of 1960 declared that National Forest System lands are to be administered for outdoor recreation, range, timber, watershed and wildlife and fish purposes, but also expressly provides that the Act shall not be construed to affect the use or administration of mineral resources on National Forest System lands.

The Forest Service administers its minerals program to (Forest Service Manual 2800 Zero code - WO amendment 2800-91-1 page 3):

1. Encourage and facilitate the orderly exploration, development, and production of mineral and energy resources within the National Forest System in order to maintain a viable, healthy minerals industry and to promote self-sufficiency in those mineral and energy resources necessary for economic growth and the national defense;

2. Ensure that exploration, development, and production of mineral resources are conducted in an environmentally sound manner and that these activities are considered fully in the planning and management of other National Forest resources; and,

3. Ensure that lands disturbed by mineral and energy activities are reclaimed for other productive uses.

The Forest Service considers mineral exploration and development to be a part of its management program (GMUG Amended Forest Plan, page II-61). It cooperates with the USDI (through its agent the BLM) in administering lawful exploration and development of leaseable minerals. While the Forest Service is mainly involved with surface resource management; the agency recognizes that mineral exploration and development are ordinarily in the public interest and can be compatible with the purposes for which the National Forest System lands are managed.

Under the Federal Leasing Program, the USDI combined major federal coal management responsibilities into one unified program in order to:

1. Give the nation a greater assurance of being able to meet its national energy objective;

2. Provide a means to promote a more desirable pattern of coal development with ample environmental protection;

3. Assure that state and local governments participate in decisions about where and when federal coal production will take place; and,

4. Increase competition in the western coal industry.

Under regulations of the Mining and Mineral Policy Act and the Federal Land Policy Management Act, responsible federal agencies must ensure the following:

1. Adverse environmental impacts on public land surface resources are minimized to the extent practical;

2. Measures must be included to provide for reclamation, where practicable; and,

3. The proposed operation will comply with other federal and state laws and regulations.

To fulfill the agencies' purpose and needs as described above, the agencies will use this EIS to analyze and consider the proposals and alternatives. A discussion of the responsibility of the BLM and the Forest Service, as well as other federal, state, and local agencies, with regard to coal leasing and mining are set forth in *Appendix B, Agency Jurisdictions (Permits and Approvals)*.

1.4 PROPOSED ACTIONS

There are three proposed actions associated with this EIS:

- Lease the Iron Point Coal Lease Tract on federal lands in Delta County, Colorado, for underground coal mining;

- Lease the Elk Creek Coal Lease Tract on federal lands in Delta and Gunnison counties, Colorado, for underground coal mining; and,

- Issue an exploration license for coal exploration on federal lands in Delta County, Colorado.

These actions, along with the No-Action Alternative, are discussed in detail in Chapter 2.0, Alternatives Including the Proposed Actions, of this EIS document.

1.5 DECISIONS TO BE MADE

The BLM and the Forest Service are the joint lead agencies responsible for completion of this EIS. OSM is a cooperating agency. OSM will prepare any MLA mining plan decisions related to these leases. These agencies are following specific procedures that began with scoping and data collection and continued with analysis of data and evaluation of alternatives. The information and analysis conducted for the original EAs are incorporated into the EIS. In accordance with regulations implementing NEPA (40 CFR 1500), the results of the environmental analysis within this EIS will form an important part of the leasing decisions to be made on the Iron Point and Elk Creek Coal Lease tracts, as well as the exploration license application for the Iron Point area. Even though the applications were submitted by private companies, the applications are processed under BLM's LBA process (43 CFR 3425) and, if approved for leasing, would be offered by competitive bid. Granting a lease gives the lessee exclusive rights and right of entry to the coal resource, however, actual mining activities must be authorized under the permitting process described later in this section.

The information and data submitted in the coal lease applications by Bowie and Oxbow do not constitute a formal underground mining permit application package to either the OSM or the Colorado Division of Minerals and Geology (DMG). This coal lease application information has been used solely to develop an impact analysis in the EIS. Its use is intended to illustrate one possible development scenario for developing federal coal reserves on the lease tracts and does not imply that either Bowie or Oxbow would be given any preference in the event that lease sales are held.

After the close of the Draft EIS review and comment period, the BLM and Forest Service considered comments submitted by the public, interested organizations, and government agencies (federal, state and local), and responded to those comments in the Final EIS. See *Appendix N, Public and Agency Participation and Involvement in the Draft EIS*. OSM, which is a cooperating agency on this EIS, assisted the lead agencies with responses to comments pertinent to areas of their jurisdiction and expertise, as requested by the BLM and Forest Service.

In accordance with 40 CFR 1503.4, the joint lead agencies considered comments and responded to these comments by:

1. Modifying the analysis as presented in the Draft EIS;

2. Making corrections for the Final EIS; and,

3. Explaining why comments do not warrant further agency response. See *Appendix N, Public and Agency Participation and Involvement in the Draft EIS.*

Under separate cover from the Final EIS, the BLM and Forest Service will issue Records of Decision (ROD) regarding their respective decisions on the leasing applications and exploration license. The RODs will be issued 30 days after the filing of the EIS.

The Colorado State Director, BLM, is the NEPA responsible signatory official for the BLM and will decide whether or not to offer the tracts for competitive leasing under the MLAct, as amended, and the federal regulations under 43 CFR 3400. The Uncompahgre Field Office Manager is responsible for the preparation of the EIS and providing the State Director with briefings and recommendations. In the RODs, the BLM responsible official may decide to:

- Adopt the No-Action Alternative (no leasing and/or exploration license);

- Adopt the proposed actions (lease the coal as applied for by the applicants and/or grant the exploration license);

- Adopt an alternative with features of several of the alternatives; or

- Adopt one of the action alternatives with additional mitigation measures.

The Forest Supervisor of the GMUG is the NEPA responsible official for the Forest Service. The Forest Supervisor must decide whether or not to consent to the BLM leasing National Forest System lands according to the Federal Coal Leasing Amendments Act of 1976. The Forest Supervisor must also prescribe terms and/or conditions (through lease stipulations) with respect to the use and protection of non-mineral interests. Once the RODs are signed and released, and if the leases are issued, the BLM would be responsible for lease administration and enforcement of lease terms and conditions. Similar decisions by the authorizing officers are required for approval of the exploration license.

If one or both of the coal leases are issued and before any mining or surface development could occur, the lessee or operator would be required to submit a Permit Application Package (PAP). The Surface Mining Control and Reclamation Act (SMCRA) gives OSM primary responsibility to administer programs that regulate the surface effects of underground coal mining. Pursuant to Section 503 of SMCRA, the Colorado DMG developed, and the Secretary of the Interior approved, a permanent program authorizing the Colorado DMG to regulate surface coal mining operations and the surface effects of underground mining on non-federal lands within the state of Colorado. In September of 1982, pursuant to Section 523(c) of SMCRA, the Colorado DMG entered into a cooperative agreement with the Secretary of the Interior authorizing the Colorado DMG to regulate the surface effects of underground mining on federal lands within the state of Colorado. The governing regulations for coal mining in the state of Colorado are the 34-33-101 *et. seq.* of the Colorado revised statutes.

Pursuant to the cooperative agreement, a federal coal lease holder in Colorado must submit a PAP to both the OSM and the Colorado DMG for any proposed coal mining and reclamation operation on lands within the state. The Colorado DMG would review the PAP to ensure that it complies with the

permitting requirements and that the coal mining operation would meet the performance standards of the approved Colorado program.

As part of the Colorado DMG permitting process, a new mining and reclamation plan or an amendment to an existing plan would be developed to show how lands in the lease tract and private/other federal owned coal would be mined and reclaimed. Specific impacts that would occur during mining would be addressed in the permit or revision, and specific mitigation measures for anticipated impacts would be identified at that time.

The Colorado DMG enforces the performance standards and permit requirements for reclamation during a mine's operation and has primary authority in environmental emergencies. OSM retains oversight responsibility for this enforcement. The BLM and Forest Service also have authority in those emergency situations where the Colorado DMG or OSM can not act before environmental harm and damage occurs.

The OSM, BLM, Forest Service and other appropriate federal agencies would review the PAP to ensure that it complies with terms of the coal lease (including any special conditions of approval), the MLA, NEPA, and other federal laws and their attendant regulations.

If compliance is met, the Colorado DMG would issue the applicant a permit to conduct coal mining operations. Under the authority of the MLA, OSM would then recommend approval, approval with conditions, or disapproval of the MLA mining plan to the Assistant Secretary of the Interior, Land and Minerals Management. Before the MLA mining plan can be approved, the BLM must concur with this recommendation, and approve a Resource Protection and Recovery Plan under 43 CFR 3482. The Forest Service must also consent/concur to the MLA mining plan prior to its issuance.

Additional details regarding federal, state, and local government agency responsibilities are set forth in *Appendix B, Agency Jurisdictions (Permits and Approvals).*

1.6 CONFORMANCE WITH LAND USE PLANS

1.6.1 BLM Resource Management Plan Consistency

The proposed actions are in compliance with the existing BLM land use plan. The Uncompahgre Basin Resource Management Plan (RMP) was completed, and approved in July of 1989. This RMP determined that the areas subject to the lease applications and exploration license applications were to be managed for both existing and potential coal development. The area is acceptable for coal development and coal production, and such coal activities could occur without conflicting with other land uses as described in the RMP.

Upon receipt of the lease applications, BLM completed tract delineation. The assessment of coal unsuitability criteria has been completed for both the proposed Iron Point Coal Lease Tract (COC-61209) and the Elk Creek Coal Lease Tract (COC-61385). The criteria has also been reviewed for implications with the other alternatives in this analysis. The unsuitability criteria published in 43 CFR 3461 were used. These coal unsuitability analysis reports are included in this EIS document as *Appendix C, Unsuitability Analysis Report - Iron Point Tract (COC-61209)*, and *Appendix D, Unsuitability Analysis Report - Elk Creek Tract (COC-61385)*. In addition, data adequacy standards were reviewed and determined to be adequate.

The land use plan was amended to address the standards for land health (i.e., Standards and Guidelines). The land analyzed in the EIS project area is within the North Fork landscape unit. This unit has not been assessed for landscape health under the BLM's Standards and Guidelines

procedures and little information on land health is available. A landscape health assessment is scheduled for the summer of 2000. Briefly, Colorado BLM's Standards are:

- Ensure health of upland soils;
- Protect and improve riparian systems;
- Maintain healthy, productive plant and animal communities;
- Maintain or increase populations of threatened and endangered species in suitable habitat; and,
- Ensure water quality meets minimum Colorado standards.

The proposed action deals primarily with underground mining. Only minor surface disturbing activities would occur on BLM managed lands. Consequently, there is little potential for actions to have a significant effect (positive or negative) to the landscape as a whole. There would be local effects where surface disturbing activities occur. For example, there would be increased potential for soil erosion and influx of weeds. It is assumed mitigation would avoid or lessen the impact. When the land health assessment is completed, BLM will determine if the land health standards are being met. If they are not being met, the causative factors will be determined and options for improvement formulated. If any permitted activities are found to affect land health, then modifications to operations as authorized by BLM will occur.

1.6.2 Forest Plan Consistency

The amended Land and Resource Management Plan (LRMP) dated September 1991, for the GMUG National Forests made provisions for coal leasing subject to the application of the coal unsuitability criteria established in 43 CFR 3461. (See *Appendix C, Unsuitability Analysis Report - Iron Point Lease (COC-61209)*, and *Appendix D, Unsuitability Analysis Report - Elk Creek Lease (COC-61385).*) The LRMP also provided for applicable stipulations to be utilized for protection of specific surface resources as addressed in Section III, General Direction, pages 63-69 of the LRMP.

The Forest Plan guides all natural resource management activities and establishes management standards and guidelines for the GMUG. Management directions described in the Forest Plan are a result of public issues, management concerns, and management opportunities. Multiple use management area prescriptions as designated in the Forest Plan (pages III-114 to 187) for the lands bounded by the two proposed lease tracts and the exploration license are summarized below.

4B - Wildlife habitat management for one or more management indicator species. Emphasis is on optimizing habitat capability for management indicator species. Other resource activities may occur, as long as habitat requirements are maintained.

4D - Aspen Management. Emphasis is on managing aspen to produce wood fiber, visual quality and plant and animal diversity while maintaining and improving aspen sites on summer range. Other activities may occur as long as management goals and objectives are maintained.

9A - Riparian/Aquatic Ecosystems. Emphasis is on the management of all the components of aquatic/riparian ecosystems to provide healthy, self-perpetuating plant communities, acceptable water quality standards, habitats for viable populations of fish and wildlife, and stable stream channels and still water body shorelines. Mineral activities may occur but must minimize disturbance to riparian areas and initiate timely and effective rehabilitation of disturbed areas and restore them to a state of productivity comparable to that before disturbance.

1.7 PUBLIC AND AGENCY PARTICIPATION AND INVOLVEMENT

As required by NEPA (40 CFR 1501.7), the BLM and the Forest Service provided for an early and open process to determine the scope of issues to be addressed and to identify the issues related to this EIS. Elements in the scoping process included the following:

- Publication of a Notice of Intent to prepare an EIS in the Federal Register (dated April 13, 1999);
- The description of the Purpose and Need, and the Proposed Actions including the nature of the decisions to be made;
- The collection of existing data and information to address the two potential lease tracts and the exploration license area;
- The initiation of public and government participation in the EIS process;
- The determination of the type and extent of analysis to be used in the preparation of the EIS;
- The identification of government agencies involved and appropriate responsible officials from the lead and cooperating agencies; and,
- The plans for the preparation of the EIS, including selection of a format for the document and development of a schedule for EIS completion and publication.

As mentioned in Section 1.2, Background, EAs were originally prepared on the lease applications. Relevant information from the EAs has been incorporated into this EIS. In addition, the Delta/Montrose Public Land Partnership and North Fork Coal Working Group (NFCWG)sponsored several community meetings regarding coal development in the North Fork Valley. Issues, concerns, and comments identified in those meetings are also incorporated into this EIS.

1.7.1 Agency Meetings and Scoping

On April 22, 1999, the BLM and Forest Service held an agency scoping meeting to discuss this EIS. Representatives from the BLM, Forest Service, OSM, Colorado DMG, Colorado Division of Wildlife, Delta County, and Gunnison County were present. On April 28, 1999, the lead agencies met with representatives from the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service. On May 18, 1999, the lead agencies met with representatives of the EPA. In addition, a project description and vicinity map were sent to the Northern Ute Tribe.

The purpose of these meetings was to familiarize these various federal, state, and local agencies with the various aspects of the North Fork Coal EIS and solicit their input on any issues regarding the planned work and the proposals.

1.7.2 Public Scoping and Involvement

As required by NEPA (40 CFR 1503), the general public, businesses, special interest groups, and government agencies were provided the opportunity to become informed and comment on this EIS process. The BLM and the Forest Service accomplished these goals by holding agency and public scoping meetings; public mailings; publishing of a Notice of Intent in the Federal Register; forming an interdisciplinary (ID) team; and preparing a scoping document.

The formal scoping process began on April 13, 1999 and ended on May 17, 1999. The BLM and the Forest Service held a public scoping meeting in Hotchkiss, Colorado on April 21, 1999.

From hearing testimony and public meeting input as well as from written comments, issues specific to the two potential coal lease tracts and the exploration license application were summarized and used as part of the criteria for completing this EIS document. Issues were used by the ID team for developing and screening alternatives, and evaluating consequences of the proposed actions. A synopsis of the issues identified for the proposed lease tracts and exploration license area is set forth in Section 1.8, Issues and Concerns, of this EIS document.

In April, July, and December 1999, newsletters were sent to individuals, organizations and agencies on the EIS mailing list to inform them on progress of the EIS and provide relevant information.

The Draft EIS was filed with the EPA and distributed to the public in late August 1999. The Notice of Availability for the Draft EIS was published in the Federal Register on September 3, 1999. In addition, the agencies transmitted press releases concerning the EIS project and process to newspaper, radio stations and television stations. The media outlets covered the North Fork Valley, Delta, Montrose, Crested Butte, Gunnison and Grand Junction areas.

A public information meeting was held on the evening of October 7, 1999 at the Hotchkiss High School (Hotchkiss, Colorado) to explain and answer questions on the Draft EIS and the coal leasing process. A formal public hearing was held on the evening of October 14, 1999 at the Hotchkiss High School for interested individuals and organizations to make oral comments and statements on the Draft EIS.

The formal comment period on the Draft EIS ended on November 3, 1999. Over 750 individual comments were received. The majority of the comments were classified in the categories of socioeconomics, transportation, and noise. There were also a number of comments that expressed opinions of support or opposition to the coal leasing proposals. See *Appendix N, Public and Agency participation and Involvement in the Draft EIS*.

1.7.3 Community Efforts

Concurrent with the preparation of this EIS, the community has undertaken efforts to deal with issues related to growth and coal mining in the North Fork Valley. A broad spectrum of interests came together to form the NFCWG and to address the issues identified.

The NFCWG is made up of local county governments, public interest groups, environmental groups, the mining companies, water user groups and concerned individuals. Other segments of the community including town and city governments, the Union Pacific Railroad, emergency service providers, and other interested groups and individuals have participated in meetings of the NFCWG and in public meetings sponsored by the NFCWG. The federal agencies have worked with the NFCWG as invited parties to provide information and resources related to the NEPA process and coal leasing in general.

The goals and objectives of the NFCWG is to work in a collaborative way and encourage the development of the community's vision for its future. The NFCWG has provided a forum to encourage community discussions, provided information and education on important issues, and developed potential mitigation and resolutions for many community issues.

The NFCWG has shared the results of their work during preparation of the EIS. In conjunction with the NEPA process, the group has submitted information during scoping and has commented extensively on the Draft EIS. Please refer to comment letter 11 in *Appendix O, Public and Agency Participation and Involvement in the Draft EIS*. Agency positions on and responses to these efforts are articulated in

Appendix O, Public and Agency Participation and Involvement in the Draft EIS. Also, potential mitigation developed by the group may be found or referenced in the various resource mitigation sections of Chapter 3.0, Environmental Analysis.

1.8 ISSUES AND CONCERNS

Scoping was conducted to focus the EIS on those issues and concerns considered important to the public and various government agencies. A scoping summary document was prepared and made publically available in July 1999.

Issues are areas of discussion, debate or dispute about the effects of proposed activities on various resources. Scoping is the procedure used to determine the extent of the analysis necessary to make informed decisions on the project proposals. From scoping input, issues specific to the proposed leasing and exploration license applications were summarized and used as part of the criteria for completing this EIS. Issues also were analyzed by the ID team for evaluating alternatives and assessing consequences.

The following are disciplines for which issues are addressed in this EIS:

- Air Quality
- Aquatic Resources/Fisheries
- Cultural Resources
- Cumulative Impacts
- Geology/Geotechnical Issues/Subsidence
- Health/Safety
- Land Use
- Noise
- Reclamation
- Recreation
- Socioeconomics
- Surface Water and Ground Water
- Transportation
- Vegetation
- Visual Resources/Lighting
- Wetlands
- Wildlife

1.8.1 Air Quality

Identify and minimize air quality impacts. Areas of concern include: the effects on air quality from fugitive dust and gaseous emissions; air quality impacts (visibility) on the West Elk Wilderness Area; and cumulative air quality effects.

1.8.2 Aquatic Resources/Fisheries

Minimize disturbance to fish habitat and fish populations. Areas of concern include: direct disturbance of stream channels; reduced flow; stream sedimentation; water quality degradation; and impacts to threatened and endangered aquatic species.

1.8.3 Cultural Resources

Identify cultural resources and minimize disturbance impacts to these resources. Areas of concern include the effects to historic properties listed or eligible for listing on the National Register of Historic Places.

1.8.4 Cumulative Impacts

Address the cumulative impacts of leasing and exploration with other potential projects. Areas of concern include: the influence of mining from the Iron Point and Elk Creek Coal Lease Tracts in association with other mining activities in the area, especially the cumulative effects of coal transportation from the North Fork of the Gunnison River area and the socioeconomic effects to the economies of Delta and Gunnison counties.

1.8.5 Geology/Geotechnical Issues/Subsidence

Identify geologic hazards on the lease sites and the potential for subsidence by underground mining activities. Areas of concern include: the potential influence of geologic hazards; the potential for and consequences of subsidence; ~~and,~~ the effects of mining on the area's geology; the potential impact of mining and subsidence on the Curecanti-Rifle 230/345 kV electric transmission line that runs parallel to Terror Creek; and, the potential effects to Terror Creek and the Terror Creek Reservoir by mining.

1.8.6 Health/Safety

Protect worker health and safety. Identify the emergency response measures that would be available in the event of a train derailment, fire, or explosion. Areas of concern for worker health and safety include: the risks from underground operations; the potential for train derailment in town; the potential responsibility for fighting fires along train right-of-ways; the possibility of an accident that would necessitate an emergency response; and, the potential for fires or explosions in the underground mines.

1.8.7 Land Use

Minimize disturbance. Areas of concern include: the acreage of disturbance; the amount of disturbance on BLM, Forest Service, and private lands; and the possible changes in future land use.

1.8.8 Noise

Identify and minimize noise impacts. Areas of concern include; level of noise from coal transportation by truck and railroad; noise from mine ventilation fans; disruptions caused by such noise to the normal activities of adjacent residents/communities; noise from Bowie No. 1 Loadout; and, night time railroad noise in Paonia, Hotchkiss, and Delta.

1.8.9 Reclamation

Provide for reclamation of disturbed areas. Areas of concern include: the successful short-term soil stability and long-term revegetation practices; reclamation of Bowie No. 1 Mine portal; and, the ability to prevent or control damage to the environment.

1.8.10 Recreation

Minimize disturbance to recreational opportunities. Areas of concern include: disruption to recreational opportunities in the undeveloped areas within and adjacent to the coal lease sites caused by background sounds, traffic, subsidence, and accessability.

1.8.11 Socioeconomics

Address the social and economic impacts on local residents of Delta and Gunnison counties. Areas of concern include: impacts to nearby communities as the result of mine closures or continuation of mining and such impacts on housing, utilities, employment, public services, community services, and present lifestyles; the effect of mine closure on workers and their families; the influx of new workers if production rates increase; and, the effects of temporary and permanent mine shutdown.

1.8.12 Surface Water and Groundwater

Identify and minimize impacts to water quality and hydrology to maintain the integrity of watersheds within and surrounding the lease tract areas. Maintain adequate flows to drainages and ditches above underground mining activity. Areas of concern include: the potential to alter existing hydrologic systems; the potential to impact irrigation canals and the Terror Creek Reservoir by subsidence; alteration of downstream flow rates; alteration of existing springs and seeps; changes in water chemistry as a result of mining operations; and, impacts to water rights on Terror Creek, Hubbard Creek, Bear Creek, and Elk Creek.

1.8.13 Transportation

Address truck and train traffic impacts created by coal mining in the North Fork of the Gunnison River Valley and the potential for accidents. Areas of concern include: the amount of train traffic in the area; the ability of the railroad to handle the projected tonnages of coal to be mined from the North Fork of the Gunnison River Valley; the increase in traffic as a result of hauling coal to the Bowie No.1 Loadout and the Terror Creek Loadout; the need for an additional rail loadout facility for the Bowie No. 2 Mine; the potential for accidents involving increased train and truck traffic; and, the risks for accidents at railroad crossings in Delta County as well as along sections of State Highway 133 subject to coal truck traffic.

1.8.14 Vegetation

Address the impacts to vegetation as a result of mining and exploration activity. Areas of concern include: the potential effects on threatened, endangered, or sensitive plants; control of noxious weeds; and, the impacts on vegetation as a result of any subsidence or surface disturbance.

1.8.15 Visual Resources/Lighting

Minimize the impacts from lights when operating at night. The concerns include: lighting from the facilities at the Bowie No. 1 Loadout, the Bowie No. 2 Mine, and the Sanborn Creek Mine.

1.8.16 Wetlands

Identify and minimize impacts to wetlands and other Waters of the U.S. Areas of concern include: the acres of wetlands lost through direct impact; the changes in functions and values of wetlands and riparian areas as a result of mining and exploration activities; and, the potential effects from subsidence on these areas.

1.8.17 Wildlife

Minimize the disruption to terrestiral wildlife and wildlife habitats. Areas of concern include: the impacts to threatened, endangered, or sensitive species; impacts to big game habitat; loss of habitat and habitat effectiveness; and, impacts associated with continued and/or increased human activity.

1.9 PAST, PRESENT AND REASONABLY FORESEEABLE CUMULATIVE ACTIONS CONSIDERED IN THIS ANALYSIS

A number of activities have, are, or will occur in the area surrounding the two lease tracts and the exploration license area. These activities primarily involve other coal exploration and mining activities, but there is also an electric transmission line, highway construction, agriculture, and some limited logging.

1.9.1 Coal Exploration

Coal exploration activities have historically and are presently occurring in areas to the north and south of the North Fork of the Gunnison River Valley near the communities of Paonia and Somerset. Coal exploration projects have been associated with nearly all of the historic coal mines shown on *Figure 3, Historic Coal Mines and Federal Coal Lease Locations*.

Bowie, Oxbow, and Mountain Coal, the three operating coal mines in the North Fork Valley, all recently have had ongoing exploration activities as part of their mining operations. These operations have exploration permits with the Colorado DMG. Bowie has conducted exploration activities on private property adjacent to the Bowie No. 2 Mine. Oxbow has conducted coal exploration on its private surface near the area of the proposed Elk Creek portal area. Mountain Coal is presently conducting underground exploration from its existing operations as well as planning to participate through its affiliate Ark Land Company, on the exploration program for the proposed Iron Point Exploration License Area. Mountain Coal has also performed surface geophysical surveys near their active permit area.

The BLM and Forest Service anticipate future exploration activities associated with the coal mines in the North Fork Valley. Although there are no formal proposals on the table, the BLM and the Forest Service also expect that there could be future exploration license requests on unleased federal coal adjacent to the operations. We estimate three additional exploration license applications over the next 10 years. The applications typically involve anywhere from five to twenty drill holes per application. It is uncertain at this time how roadless area issues currently before the Forest Service would affect future exploration license applications.

1.9.2 Coal Mining Operations and Associated Activities

1.9.2.1 Past Coal Mining Activities

Underground coal mining has occurred in the North Fork of the Gunnison River Valley for the past 100 years. Coal mining has occurred on both private and public lands in the general area. The location of the historic coal mining operations are shown on *Figure 3, Historic Coal Mines and Federal Coal Lease Locations*. For more information on the historic mining in the area, see *Appendix G, Historic Coal Mining Activity*.

1.9.2.2 Present Coal Mining Activities

At present, there are three existing operating mines, as well as one idle underground coal mine in the North Fork Valley. These are the Bowie No. 2 Mine, the Sanborn Creek Mine, and the West Elk Mine.

The Bowie No. 1 Mine is currently idle under provisions of a temporary cessation approval from the Colorado DMG. There are also two remote coal loadouts in the area. These are the Bowie No. 1 coal loadout and the Terror Creek coal loadout. Details of these activities are discussed below.

Bowie No. 1 Coal Mine. At present, the Bowie No. 1 Mine is idle under provisions of a temporary cessation approval from the Colorado DMG. There is no current coal production from this mining operation. The Bowie No. 1 Mine is permitted with the Colorado DMG for a production rate of 1.5 million tons of coal per year. This operation was developed by Colorado Westmoreland Inc. in the late 1970s, subsequently sold to Cyprus Coal Company who operated the mine until 1994, whereupon it was sold to Bowie. The Bowie No. 1 Mine was operated as a room and pillar type operation, with coal being hauled from the mine portal area to the Bowie No. 1 Loadout near Paonia.

In 1986, an underground mine fire closed the operation. Although the Mine Safety and Health Administration (MSHA) subsequently allowed the mine to re-open, there remains an area of coal reserves to the west of Terror Creek in Federal Coal Lease Tract No. COC-37210. This area of coal reserves is known as the Bowie No. 1 “pod.” The fire severely hampered the access to this area, and officials from Bowie indicate that they have been exploring various scenarios that would allow access and recovery of this coal. (Refer to Section 2.4.2, Alternative B - Offer Iron Point Coal Lease as Applied for by Applicant, Section 2.5.2, Alternative C - Offer Iron Point Coal Lease for Multi-Seam Mining, and Section 2.6.2, Alternative D - Offer Iron Point Coal Lease With Stipulation That There be no Subsidence in Sensitive Areas.)

Bowie No. 1 Coal Loadout. The Bowie No. 1 Loadout is located northeast of the community of Paonia. This facility includes a truck dump area, conveyors, three silos with a capacity of 8,000 tons each, and a batch loadout tower for loading the railroad cars. Presently, Bowie is trucking coal from the Bowie No. 2 Mine to the Bowie No. 1 Loadout. This loadout was originally permitted and constructed by Colorado Westmoreland Inc. in the late 1970s to serve as the loadout from its mining operations (presently the Bowie No. 1 Mine). Coal is currently hauled from the Bowie No. 2 Mine to the Bowie No. 1 Loadout with highway trucks under a contract between Bowie and Savage Trucking Inc. Bowie has filed a technical revision with the Colorado DMG to increase the tonnage for the Bowie No. 1 Loadout up to 5 million tons per year.

Bowie No. 2 Coal Mine. Bowie is presently conducting coal mining operations from its Bowie No. 2 Mine; the mine has recently added a longwall system to replace its room-and-pillar mining techniques. Coal is transported from the underground mine to the portal bench via a conveyor. From the portal coal storage areas, coal is currently loaded on trucks and hauled to the Bowie No. 1 Loadout.

Since the release of the Draft EIS, Bowie has applied for approval of a permit revision from the Colorado DMG for the construction and operation of a conveyor which would transport coal from the portal bench to a proposed new coal handling storage and truck loadout area adjacent to Old State Highway 133.

At the time of release of the Draft EIS, the Bowie No. 2 Mine was permitted for 2 million tons of production using room-and-pillar techniques. Since the Draft EIS release, Bowie has also applied for approval of a permit revision for the longwall system upgrade from the Colorado DMG. With the installation of a new longwall system, Bowie could increase production within its permit boundaries to 5 million tons of coal per year. As noted earlier, Bowie's installation of the longwall is economically feasible only if Bowie is the successful bidder on the Iron Point Coal Lease Tract.

If Bowie is the successful bidder for the Iron Point Coal Lease Tract, the company has indicated the likelihood that a new coal train loadout would be constructed adjacent to the current mine such that truck haulage would no longer be necessary to the Bowie No. 1 Loadout from the Bowie No. 2 Mine.

In addition, if a new loadout is constructed adjacent to the Bowie No. 2 Mine, the mining operation would be directly connected by conveyor to the new train loadout, thereby eliminating major truck haulage from the Bowie No. 2 Mine.

Sanborn Creek Coal Mine. The Sanborn Creek Mine, operated by Oxbow, is located northeast of the community of Somerset. This mine is permitted with the Colorado DMG for an annual production of up to 4 million tons per year. The mine is permitted with the Air Pollution Control Division of the Colorado Department of Public Health and Environment for air emissions associated with an annual production rate of 4.8 million tons. The mine has the potential to produce 6 million tons per year from its longwall system with no major changes in the operation.

In January 1999, the Sanborn Creek Mine was shutdown when elevated CO was detected in the mine ventilation exhaust As a result of a mine fire, the mine was sealed and the affected longwall panel area in the mine was flooded with water. After working with MSHA throughout most of 1999 on safety issues and precautions, Oxbow has re-opened the mine and resumed coal production.

Coal mined by the longwall system from the Sanborn Creek Mine is conveyed from the underground workings to surface coal handling and loadout facilities located immediately north of the community of Somerset. Recent construction has added additional coal storage capability along with a new batch loadout facility for train car loading.

Oxbow is the applicant for the Elk Creek Coal Lease Tract. Oxbow has filed a technical revision to its current permit with the Colorado DMG and is planning to construct a new portal pad on their private (fee) property in Elk Creek regardless of the outcome of the lease sale for the Elk Creek Tract. If successful in obtaining the lease, Oxbow would use these surface facilities located on private surface to extend its coal mining activities into the Elk Creek Coal Lease Tract.

Terror Creek Coal Loadout. This loadout is a custom coal loadout facility, with coal being shipped to specialized customers such as cement plants and other industrial complexes that use coal. See *Figure 1, General Location Map*, for the location of the Terror Creek Coal Loadout. The Terror Creek Coal Loadout is owned by Oxbow (88%) and the Bear Coal Company (12%), but the facility is operated by Oxbow. This loadout facility is permitted to handle approximately 500,000 tons of coal per year. The coal is hauled to this loadout from all three mines operating in the valley. Coal from the Somerset facilities is hauled by Oxbow-owned highway trucks. Coal from the other mines is hauled by Savage Industries or other licensed haulers.

West Elk Coal Mine. The West Elk Mine is located south and east of the community of Somerset, approximately 3 miles from the Elk Creek Coal Lease Tract and 6 miles from the Iron Point Coal Lease Tract. This mine is operated by Mountain Coal and is permitted with the Colorado DMG at a production rate of 8.2 million tons of coal per year. This mine was opened in the early 1980s. A longwall system of operation was added in 1991. The West Elk Mine produces coal from several federal coal leases, and the company has worked with the Forest Service on a number of exploration applications in the past. The agencies also understand that Mountain Coal is considering the possibility of a new portal and facilities in Sylvester Gulch located on private land.

In 1998, Mountain Coal shipped 5.9 million tons of coal from the West Elk Mine, but projects that it could ship up to 7.3 million tons in 2000 and 8.2 million tons in 2005. It is important to note that this EIS document has been completed as a result of Bowie and Oxbow's LBA submittals, and that the cumulative impacts evaluated in this EIS document that include Mountain Coal relate to air quality, coal production, transportation, and socioeconomics. Certain site-specific effects, such as subsidence, as well as current and proposed future mining at the West Elk Mine, are not included in this EIS

document. Any subsequent changes or revisions made for the West Elk Mine would be addressed in separate NEPA analyses.

1.9.2.3 Reasonably Foreseeable Coal Mining Activities

Mining operations have been conducted in the valley for many years. (See *Appendix G, Historical Coal Mine Activity* and *Figure 3, Historic Coal Mines and Federal Coal Lease Locations*.)

It is reasonably foreseeable that underground coal mining activities will continue into the future in the North Fork Valley. Accurate predictions as to how long such underground coal mining will continue is difficult, if not impossible. Coal mining activities are affected by many aspects, such as capital intensity, cost structure, risk, and coal markets. See *Appendix E, Mining Economics*. If the demand for clean coal continues, and the present market conditions persist, the BLM and the Forest Service and envision 10 to 20 years of future mining activity in the North Fork Valley. Presently, coal mining economics in the western United States hinder extraction of coal from underground mining operations at depths greater than approximately 2,500 feet. It is likely that mining technology and economics will allow western coal operators to extract coal from deeper, and possibly thinner, coal seams in the future. Subjectively it is probably safe to say there has been more coal mined than there is left to mine with existing technology. Still, given the situation described above, it is difficult to project with any certainty what coal activities will occur in the future. However, for the purpose of this document and to better understand the nature of the possibilities that exist, the agencies have developed the following estimates. There are currently no formal plans or applications before the agencies. Additional NEPA documentation would be required on any applications submitted.

For leasing, should Bowie and Oxbow obtain the applied for lease tracts they would have reserves for approximately 10 years. Data gathered from the Iron Point Exploration License would provide information on leasing possibilities to the north in the longer term. It is estimated that Mountain Coal will need a lease within the next 10 years to sustain their operation. The most likely area would be to the south and/or east. There are additional coal reserves to the west towards Cedaredge, however the coal quality is lower. The BLM offered a tract in that area at the last Regional Coal Team sale. There was no bidder at that time and consequently interest in leasing in that area is speculative at best. There is no information to suggest and the agencies do not foresee any interest in a new and fourth active mining operation in the valley.

Modifications are limited to one action per lease and further limited to 160 acres in size. There are currently four possible coal lease modifications for which applications could be received. Two of the four applications have been submitted as one application to the BLM by Mountain Coal. One of the other possible modifications is a remote possibility that involves deep cover. Should the two lease tracts be issued, there would be one additional modification possible for each lease. Typically, modifications do not involve any substantial surface disturbance or additional impacts over and above the existing operation.

1.9.3 Electric Transmission Line

The Western Area Power Administration owns and operates the Curecanti-Rifle 230/345 kV electric transmission line that essentially parallels Terror Creek, west of the Bowie No. 2 Mine. The right-of-way for this transmission line is 125 feet in width, which includes access roads. The transmission line structures are steel lattice with buried reinforced concrete bases. This line is currently in use and will be into the future.

1.9.4 State Highway 133

State Highway 133 is located adjacent to the North Fork of the Gunnison River and is the main road that accesses the coal mines in the Paonia and Somerset area. This highway connects Hotchkiss with Carbondale, Colorado, and traverses McClure Pass. Over the past 20 years, the Colorado Department of Transportation (DOT) has funded and overseen upgrades and relocations of this highway in an area east of Paonia to the inlet of the Paonia Reservoir. In 1999-2000, the Colorado DOT has contracted for the upgrade of a 5-mile section of State Highway 133 immediately downstream of the Paonia Reservoir. This upgrade will involve straightening, widening, and repaving activities. Other routine maintenance and upgrades will continue into the future.

1.9.5 Agriculture

Agricultural activities have historically been, and continue to be, a prominent part of the local Paonia economy. Fruit production is generally confined to the valley floors and low mesas/terraces adjacent to the North Fork of the Gunnison River. In recent years, vineyards (and several wineries) have been developed and are being operated in the Paonia area.

Sheep and cattle grazing also occurs on pastureland in the Paonia area, with summer livestock grazing occurring in the higher elevations above the Bowie and Oxbow operations, including lands within and surrounding the proposed Iron Point and Elk Creek Coal Lease Tracts.

1.9.6 Water Storage and Irrigation Canals

To serve agricultural activities, as well as some domestic use, there are a number of water storage reservoirs and irrigation canals. The Terror Creek Ditch and Reservoir Company operates and maintains the Terror Creek Reservoir (also known as the Bruce Park Reservoir) and Terror Creek Canal to provide water for agricultural and domestic users on Garvin Mesa. The Terror Creek Reservoir and Terror Creek are shown on *Figure 1, General Location Map*.

Other canals, such as the Fire Mountain Canal, the Deer Trail Ditch and the Stewart Ditch, essentially parallel the North Fork of the Gunnison River to provide gravity feed irrigation water for agricultural purposes.

1.9.7 Logging

There is minimal logging in the vicinity of the two coal lease tracts and the exploration license area. Hotchkiss Ranches Inc. has harvested several aspen stands on their property which is located within and surrounding the Elk Creek Coal Lease Tract. Some products other than logs, such as fence posts and fuel wood, have been harvested off federal lands within and adjacent to the coal lease tracts and exploration license areas, but this activity has been limited.

From 1980 through 1999, there have been several timber sales on National Forest lands in the Terror Creek and Hubbard Creek watersheds. Over the past 20 years, approximately 1,383 acres have been harvested within these two watersheds. The majority of the harvest activities involved the regeneration of aspen stands through the practice of clear cutting. A small percentage of the spruce fir stands have been harvested with intermediate partial cuts.

Small timber sales will probably occur in the future, but no major timber sales are planned by either the BLM or the Forest Service in the vicinity of the two coal lease tracts and the exploration license area.

1.9.8 Railroad

The Union Pacific owns and maintains the "North Fork Branch," the rail spur line that provides services to the coal mines in the North Fork of the Gunnison River Valley. This spur line is approximately 95.5 miles in length. It originates in Grand Junction and passes through the communities of Delta, Hotchkiss, Paonia, and Somerset Colorado. This line serves the Bowie No. 1, Terror Creek, Oxbow, and West Elk coal loadout facilities. In 1998, this spur line handled approximately 850 trains and hauled an estimated total of 8.6 million tons of coal from the various North Fork coal loadouts. The Union Pacific, as part of their normal practice, plans and undertakes a schedule of maintenance and upgrades on this spur line.

Presently, there are two coal train sidings on the North Fork Branch. One is near Roubideau (between Grand Junction and Delta) and the other on Rogers Mesa near Lazear (between Delta and Hotchkiss). These sidings are used to allow coal unit trains to pass on the North Fork Branch. As part of the need for future management of coal shipments from the North Fork coal mines, the Union Pacific is considering the installation of two new sidings (one at Whitewater and the other at Payne), as well as the "Y" side track at Converse (the Bowie No. 1 Loadout), if and when a new train loadout is constructed adjacent to the Bowie No. 2 Mine.

1.9.9 Recreation

There are no developed recreational facilities operated by the BLM or Forest Service on the proposed coal lease tracts and exploration license area. Hunting is the primary recreation activity within and adjacent to the proposed coal lease tracts and exploration license area. Other dispersed recreational activities occur in the area, but on a limited basis due to the lack of developed facilities. Four-wheeling, hiking, picnicking, horseback-riding, snowmobiling, and general sight-seeing have been mentioned as occurring.

1.9.10 Housing Development

In recent years, the area within and surrounding the communities of Paonia, Hotchkiss, Crawford, and Delta, Colorado have experienced an influx of population and the construction of new housing. This region of Colorado seems to be attractive to new "migrants" because of a number of factors including the area's natural beauty, low land costs, sparse population, minimal land use controls, and low cost of living. The new housing development is "down-valley" from the proposed coal lease tracts and exploration license area.

1.9.11 Oil and Gas

There are no oil and gas leases located on or near the coal lease tracts or the coal exploration license area. The potential for the discovery of conventional resources of oil and gas under either lease tract or the coal exploration license area is very slight. Dry wells have been drilled to the Dakota Sandstone a few miles to the southwest and to the northwest of the lease tracts.

Recently, there have been expressions of interest for leasing oil and gas filed in the area. Interest in coal bed methane has never been high in the immediate area; however, the expressions of interest in leasing are presumed to be associated with coal bed methane.

1.10 AGENCY JURISDICTIONS (PERMITS AND APPROVALS)

Preparation of an EIS at the leasing stage and the actual mine permitting processes are related but distinct. An EIS is designed to explore alternatives, mitigation measures, and environmental impacts. The permitting processes give individual government decision-makers the authority to grant approvals

and issue permits with requirements and conditions to eliminate and/or mitigate specific adverse environmental impacts which are identified in the EIS. See *Appendix B, Agency Jurisdictions (Permits and Approvals)*, for details of tentative approvals and permits needed for exploration and mining activity.

A number of federal, state, and local permits and approvals would be required for actual mining of the coal in the Iron Point and Elk Creek Coal Lease tracts. See *Appendix B, Agency Jurisdictions (Permits and Approvals)*.

BLM decisions can be immediately effective and are typically issued 30 days after the Final EIS is issued. Forest Service decisions are usually issued with the Final EIS. Implementation occurs after the close of a 45 day appeal period, and a 5 day administrative stay if there are no appeals.

1.11 ISSUES OUTSIDE THE SCOPE OF THIS EIS

The two proposed coal lease tracts and the exploration license area are not located in any areas of critical environmental concern; in or adjacent to the corridor of a designated, eligible or potentially eligible wild and scenic river, prime or unique farmlands, or wilderness areas. There are no effects anticipated on any Forest Service trails in the area. Also, there would be no affects on any wild horses or burros.

Over the past several years, there have been three possible projects in the greater area that could have a cumulative impact. These are the Dominquez Canyon Reservoir, AB Lateral Diversion, and Mount Emmons Molybdenum Mine. At this time, there are no immediate applications or proposals being offered for the Dominquez Canyon Reservoir. The future outlook for this project is speculative at best. The AB Lateral Diversion remains under study and consideration by the Bureau of Reclamation, but there are no firm plans for this project. Historically, the AB Lateral Diversion project has been an "on again-off again" proposal. There seems to be insufficient impetus or support to move the project forward. It has been reported that a supplemental EIS may be issued for this project in the winter or spring of 2000, but the future outlook for this project is uncertain. The Mount Emmons molybdenum mine project near Crested Butte, Colorado, remains mostly dormant and its future outlook is uncertain. In fact, substantial molybdenum could be brought to market from existing mines to meet demand. The future outlook for these three projects is speculative at best. Consequently, the BLM and Forest Service consider them outside the scope of this EIS.

On February 11, 1994, the President issued Executive Order 12898 on environmental justice for minority and low income populations. The purpose of the Order is to identify and address, as appropriate, disproportionately high and adverse human health and environmental effects of programs, policies or activities on minority or low income populations. There are no low income or minority populations in the area that could be disproportionately affected by the proposed actions.

Listed below are a few examples of actual comments received during scoping that illustrate the types of issues that the BLM and Forest Service considered outside the scope of this EIS:

- The EIS should disclose that Oxbow Carbon and Minerals previously requested the BLM to investigate whether or not there could be a lease option sale prior to conducting the EIS, and the reasons for this request: those being that since allegations had been made by credible parties that Bowie intended to bid on Oxbow's proposed lease of federal coal reserves in the Elk Creek Tract, and since the mine operators are paying the third-party contractors developing the EIS, that Oxbow wanted to resolve the competitive bid process prior to paying for the EIS.

- Money invested by Bowie and Oxbow will sway the EIS.

- We need health studies dealing with sleep deprivation, especially in children.

- We must do everything to maintain the balance between coal, agriculture, recreation, tourism, and to preserve the uniqueness of this valley.

- I would like to see an in depth study done on the three major companies, (Bowie, Oxbow, and Mountain Coal) regarding the safety record, the integrity, and the honesty of these companies based on past performance. And I would like to see this information made available to the public.

- Should corporate responsibility be considered by the community?

- Have local mines paid their bills on time and followed the applicable rules and laws?

- To what extent have they been good and/or bad neighbors?

- How about researching methane gas recovery to prevent another mine-closing explosion? A project could be developed to convert the gas to a utility heating plant.

- I would like to inform the people that approximately 80 percent of the electricity in the U.S. is produced with coal.

- Would government subsidies be required if agencies didn't lease for coal?

- Can we have a broader discussion on energy alternatives and job alternatives?

- We must be weary of all seeking in roads and to foray in pursuit of short sided ambition. Pandering for businesses and corporations must cease.

Scoping issues were not carried forward in the analysis because they were determined to be outside the scope of the EIS, do not address the purpose and need, or are outside the agencies' jurisdiction.

Chapter 2

Alternatives Including the Proposed Action

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

The discussion of alternatives is the foundation of the Environmental Impact Statement (EIS) process (see 40 CFR 1402.14). The Bureau of Land Management (BLM) and the USDA Forest Service (Forest Service) have explored and evaluated numerous ideas and options during the selection and development of the alternatives which include a No-Action Alternative and the actions as proposed by the applicants for the exploration license and the coal lease tracts. In total, four alternatives (including the No-Action Alternative) have been developed for evaluation in this EIS.

This chapter also includes reclamation, management, mitigation, and monitoring measures which would be associated with the implementation of any of the action alternatives. The environmental consequences associated with each of the alternatives are analyzed in Chapter 3.0, Environmental Analysis.

The BLM and the Forest Service used engineering, reclamation, and environmental baseline and background information and data to develop this EIS document. There have been visits to the existing Bowie No. 2 Mine, the Sanborn Creek Mine, and the West Elk Mine by agency personnel and the third-party contractor. These visits have resulted in familiarity with the existing mining, the surrounding area, and an insight regarding future mining in the region, as proposed, as well as a working understanding regarding the range of possible alternatives.

2.2 FORMULATION OF ALTERNATIVES

Alternatives were developed and analyzed to respond to the purpose for and need of the proposed actions, to address social and environmental issues, to respond to public and agency concerns and input, and to satisfy regulations of the National Environmental Policy Act (NEPA). In the NEPA process, the agencies are obligated to consider a range of reasonable alternatives spanning literally hundreds of choices available to the decision-makers.

The interdisciplinary (ID) team of the BLM and the Forest Service met on June 17, 1999 to consider possible alternatives with regard to this EIS. A number of ideas and options were identified; some were eliminated from consideration if they clearly could not meet the proposal objectives or address the issues.

The overall goal in developing alternatives for the EIS was to assure that such alternatives would be considered reasonable as specified by 40 CFR 1502.14. Further, the alternatives developed give the decision-makers options of selecting one, or a combination of alternatives in the final decision. The ID team considered the following types of questions while debating the selection of reasonable alternatives:

1. Does the alternative meet the purposes and objectives of the lease/exploration license, applicants and the agencies on behalf of the public?

2. Does the alternative protect surface resources while allowing the applicants to conduct exploration?

3. Do the alternatives protect surface resources while allowing the maximum economic recovery of the coal resources in the leases?

4. Do the alternatives provide for technical and economic feasibility for exploration and mining?

5. Do the alternatives, while meeting the proposals' objectives, provide a lower environmental cost or decreased level of environmental degradation?

6. Do the alternatives interfere with any rights or obligations under the mining regulations of the Colorado Division of Minerals and Geology (DMG) and the Mineral Leasing Act requirements administered by the Office of Surface Mining Reclamation and Enforcement (OSM).

The objective of developing and reviewing alternatives for this EIS is to provide BLM and Forest Service decision-makers and the public with a range of reasonable alternatives for consideration. One of those alternatives is the No-Action Alternative, which NEPA requires to be discussed in any EIS document (40 CFR 1502.14).

Under the action alternatives, the BLM would hold coal lease sales for the Iron Point and Elk Creek Coal Lease Tracts, subject to coal lease stipulations of the BLM and the Forest Service and any coal lease stipulations developed as part of this EIS process. Each of the action alternatives (B, C and D) by design apply coal lease stipulations. Any coal lease tract offered for competitive sale would be bound by the conditions of the standard lease form (see *Appendix H, Standard BLM Coal Lease Terms, Conditions and Stipulations*), restrictions developed from application of the unsuitability criteria (see *Appendix C, Unsuitability Analysis Report - Iron Point Coal Lease Tract (C-61209)*), and *Appendix D, Unsuitability Analysis Report - Elk Creek Coal Lease Tact (C-61357)*, and Forest Service stipulations for coal leasing (see *Appendix I, Forest Service Stipulations - Iron Point Coal Lease Tract (C-61209)*, and *Appendix J, Forest Service Stipulations - Elk Creek Coal Lease Tract (C-61357)*). The lease-by-application (LBA) process is, by law, an open, public, competitive, sealed-bid process whereupon the coal lease would be granted to the highest qualified bidder.

Following the completion of the NEPA process, and issuance of Records of Decision, if approved, the BLM would hold coal lease sales. The lessees who are successful in obtaining the coal lease tracts must provide engineering detail, along with reclamation and closure plans, designed to comply with terms, conditions, and stipulations applied to the lease as a result of the NEPA analysis to the Colorado DMG. Prior to any mining activities within the lease boundaries, the detailed design, operation, and reclamation activities of the lessee(s) must meet OSM, BLM, and Colorado DMG mine plan and permitting regulations and guidelines. Such assurances would be required to obtain the necessary permits and approvals to conduct actual mining operations.

The BLM and the Forest Service, with input from the OSM (cooperating agency), have explored and objectively evaluated numerous project alternatives. The federal agencies used information developed during scoping to analyze potential alternatives. The objective of this discussion was to develop a reasonable array of alternatives for analysis in the EIS.

The agencies have chosen four alternatives (No-Action plus three action alternatives) for consideration in the EIS which range from no leasing/denial of the exploration license (No-Action) to granting both leases and approving the exploration license.

The following is a brief synopsis of the alternatives analyzed in this EIS:

- **Alternative A - No-Action Alternative.** This alternative assumes no leasing would occur and that the exploration license would be denied. At the time of release of the Draft EIS, the Bowie No. 2 Mine was permitted for an annual coal production of 2 million tons using room-and-pillar underground mining techniques. Since the Draft EIS release, Bowie has applied for permits from the Colorado DMG for a longwall system installation which gives Bowie the ability to produce 5 million tons of coal annually. These permits are still under review and waiting on final resolution of water right issues with the State Engineer. The agencies now assume the No-Action Alternative would involve a 5 million ton annual production rate for

Bowie, as well as an estimated annual production rate of 5 million tons of coal from Oxbow's Sanborn Creek Mine. The agencies are still considering a production rate of 2 million tons of coal per year from Bowie as a pre-existing condition for analysis of impacts in Chapter 3.0, Environmental Analysis. The No-Action Alternative does not consider the interruption of coal production at the Sanborn Creek Mine due to the recent mine fire.

- **Alternative B - Proposed Action.** This alternative was generated based on the original coal lease applications submitted by Bowie and Oxbow. The proposed action for the Iron Point Coal Lease Tract assumes a northern boundary south of the Terror Creek Reservoir, along with an area that would provide access under Terror Creek to coal reserves to the west of Terror Creek in existing federal coal lease number C-37210. Production from the Iron Point Coal Lease Tract was assumed to be 5 million tons per year via longwall mining techniques.

  The Elk Creek Coal Lease Tract includes 160 acres added to the proposed lease tract in Section 32 (the northeast corner of the lease tract). This is acreage added to the lease tract by the BLM. Production from the Elk Creek Coal Lease Tract was also assumed to be 5 million tons per year. Although not currently permitted for any increase in annual coal production, Oxbow indicated a potential to produce 6 million tons of coal annually from its operation. Oxbow wanted to ensure some future flexibility with regards to its operations. For most disciplines, a potential increase by Oxbow to an annual production rate of 6 million tons would have a negligible effect; however, for certain disciplines such as transportation and socioeconomics, the BLM and Forest Service have considered this potential production rate and discussed such impacts in Chapter 3.0, Environmental Analysis. Coal mining would be accomplished by longwall mining techniques on the Elk Creek Coal Lease Tract.

- **Alternative C - Multiple Seam Mining.** This alternative is similar to Alternative B, with the inclusion of additional reserves in the B coal seam in the Iron Point Coal Lease Tract, as well as additional surface area and reserves that are located between the Iron Point and Elk Creek Coal Lease Tracts. An area was also added to the Iron Point Coal Lease Tract in the Terror Creek drainage to facilitate the location of possible entries beneath Terror Creek to access coal in the Bowie No. 1 pod. These coal reserves are located in the existing federal coal lease C-37210. See *Figure 3, Historic Coal Mines and Federal Coal Lease Locations*. In Alternative C, mining would be completed by longwall techniques, and annual coal production would be the same as outlined in Alternative B.

- **Alternative D - Subsidence Protection.** This alternative would be the same as Alternative C with the limitation that there would be no subsidence under Terror Creek, Hubbard Creek, or the Curecanti-Rifle 230/345 kV electric transmission line. The tract boundaries have been modified between the Draft and Final EIS based on comments and additional information received. See Section 2.6, Alternative D - No Subsidence in Sensitive Areas.

Alternatives B, C, and D analyze the development of the coal lease tracts under reasonably foreseeable scenarios. These scenarios are judged by the agencies to be essentially "best estimate" mining plans which account for the competitive nature of coal leasing. It is assumed that for each lease tract, coal could be mined to the tract boundaries using longwall extraction techniques with continuous miner development and standard industry practices. See *Appendix F, Overview of Underground Coal Mining.*

For the Elk Creek Tract, it is foreseen that coal from the D seam could be extracted from a series of north-south oriented longwall panels. In the Iron Point Tract, coal from the D seam could be accessed by east-west oriented longwall panels in the southern portions of the tract, and by north-south panels in the northern portions. Alternatives C and D also consider mining the B (lower) coal seam in the Iron Point Tract. The B seam reserves could be accessed in a similar configuration as the D seam.

If another party would be the successful bidder, the BLM and the Forest Service have determined that the most probable course of action would be that the leases be accessed through existing portals. In the unlikely event that a lessee would want to construct a new and separate portal facility, a supplemental NEPA analysis would be required to determine the impacts resulting from such action. The analyses in Chapter 3.0, Environmental Analysis, are based on assuming longwall mining and subsequent subsidence would occur.

During deliberations about alternatives, the BLM and Forest Service discussed the possibility of setting production limits on one or both of the coal lease tracts. In addition, there was discussion amongst the agencies about the possibility of staggering the lease sales. The general concept behind these two options was to consider the possible reduction of overall coal production from the North Fork Valley, thereby reducing potential impacts from mining and transportation of coal, while at the same time extending the potential socioeconomic benefits over a longer time period.

The BLM's current regulations provide for leasing by application (see comment response 25-7). Because the two applications came in at approximately the same time we must act on them in accordance with the applicable regulations. In the LBA process, the suggested alternative would be the same as the No-Action Alternative for one or the other of the leases. In the NEPA process we are obligated to consider a range of reasonable alternatives spanning the literally hundreds of possible choices available to the decision maker. Our alternatives range from No-Action on both leases to the granting of both. It is possible that one or both lease applications could be denied relying on this analysis.

Alternatives range from no-action on both leases to the granting of both. It is possible that one or both lease applications could be denied relying on this analysis.

Setting production limits was not deemed a "reasonable alternative", as defined by NEPA requirements for the following reasons. The BLM is mandated to ensure maximum economic recovery of coal (43 CFR 3480). Limiting coal production or the use of a mining technique other than longwall would not allow recovery of all mineable coal reserves resulting in waste or loss of the coal resources.

In addition, setting production limits could result in an alternative that would be economically infeasible given today's longwall technology. (See Section 2.8.2, Room-and-Pillar Mining (No Longwall Mining) of the Iron Point and Elk Creek Coal Lease Tracts.) A limited production alternative we believe would be economically infeasible in the current coal market, and therefore would not meet the purpose and need articulated in Chapter 2.0, Alternatives Including the Proposed Action.

Further, setting production limits in any meaningful and/or fair way would go well beyond the authority of the agencies and would be unreasonable and indefensible. The mines are also producing coal from fee lands that are not regulated by the BLM or the Forest Service. The decisions to be made through this process are limited to the publicly owned coal to be leased from the Elk Creek and Iron Point Coal Lease tracts. It would be inappropriate of the agencies to attempt to assert some broader control.

It should be noted that the information and data submitted in the coal lease applications by Bowie and Oxbow do not constitute a formal underground mining permit application package (PAP) to the Colorado DMG. This coal lease application information has been used solely to develop an impact analysis in the EIS. Its use is intended to illustrate one possible plan for developing federal coal

reserves on the lease tracts and does not imply that either Bowie or Oxbow would be given any preference in the event that lease sales are held.

Alternative B, C, and D also analyze the effects of issuing the exploration license according to a potential development scenario. *Figure 4, Iron Point Exploration Plan*, shows potential locations of exploration drill holes. The locations are estimates but are very close approximations to where the drill holes would be located. Most of the proposed locations have been visited and the potential sites located to minimize potential impacts.

The details of Alternatives A, B, C and D are set forth in the following sections. All of the action alternatives are consistent with the Grand Mesa, Uncompahgre and Gunnison Forest Plan.

Prior to initiating any work involved with any approved action alternative(s), the applicable lessee(s) must not only file and secure the necessary permits, but also must file reclamation performance securities with the Colorado DMG and OSM for any exploration or mining activities. These securities would not be released until the Colorado DMG and OSM determined that adequate closure and reclamation have been successfully completed.

2.3 ALTERNATIVE A: NO-ACTION ALTERNATIVE

NEPA requires that an EIS discuss the No-Action Alternative. This section outlines the No-Action Alternatives for the Iron Point Exploration License, the Iron Point Coal Lease Tract, and the Elk Creek Coal Lease Tract.

2.3.1 Alternative A: No-Action Alternative - Iron Point Exploration License

Under this alternative, approval for the exploration license would be denied. The No-Action Alternative would preclude any exploration in the Iron Point exploration plan area.

2.3.2 Alternative A: No-Action Alternative - Iron Point Coal Lease Tract

Under the No-Action Alternative, the Iron Point Coal Lease Tract COC-61209 would not be offered for competitive sale at this time. For purposes of this EIS analysis, the No-Action Alternative assumes that the federal mineable coal in the proposed lease area would not be mined.

If the decision would be not to lease, it would be assumed for this EIS that Bowie would continue mining its fee (private) coal reserves.

The following describes current activities for the Bowie No. 2 Mine should the No-Action Alternative be selected for the Iron Point Coal Lease Tract.

Project Location. The Bowie No. 2 Mine is located approximately 5 miles northeast of Paonia, north of State Highway 133, and is situated at an elevation range of approximately 6,000 to 8,000 feet. See *Figure 1, General Location Map*.

Nature of Coal and Coal Reserves. Bowie is presently mining coal reserves from the D seam. The D seam ranges in thickness from 8 to 16 feet, with an average mineable thickness of 10 feet. Bowie also has B seam coal reserves that could be mined from the Bowie No. 2 Mine.

The average run-of-mine coal quality for the D coal seam, on an as-received basis, is as follows:

BTU/pound:	12,000
Moisture:	9-10%

Ash:	7-8%
Sulfur:	<0.5%

As of May 1999, the Bowie No. 2 Mine has approximately 5 to 6 million tons of mineable D seam coal within its approved permit area.

Surface Facilities. The Bowie No. 2 Mine is an existing underground mining operation. The mine portals and major surface facilities are located about 800 feet above old State Highway 133 at an elevation of approximately 6,880 feet where the D seam subcrops. The surface facilities consist of sediment control structures, coal handling facilities, support facilities for mine operations, and other related facilities.

Coal mined from the Bowie No. 2 Mine is trucked to the Bowie No. 1 Loadout northeast of the town of Paonia, Colorado. See *Figure 1, General Location Map*. The Bowie No. 1 Loadout is an existing unit train loadout facility.

Bowie also plans to construct a conveyor belt from the existing Bowie No. 2 portal area surface facilities to a location immediately adjacent to the old State Highway 133. At this lower location, next to the old state highway, a coal storage and truck loadout area would be constructed. At this new storage facility, coal can be loaded directly into trucks and hauled to the Bowie No. 1 Loadout, thus eliminating truck use of the relatively steep and windy road from the portal pad to old State Highway 133.

Bowie has discussed the possibility of constructing a new train loadout at the Bowie No. 2 Mine; however, Bowie has indicated that they would probably not construct this train loadout if they were unsuccessful in obtaining the Iron Point Coal Lease Tract.

Mining Techniques. Since the issuance of the Draft EIS, Bowie has installed a longwall system at the Bowie No. 2 Mine, thereby replacing room-and-pillar mining at this operation. A discussion on room-and-pillar mining, as well as longwall mining, is set forth in *Appendix F, overview of Underground Coal Mining*.

Operating Schedule. Bowie mining operations are presently conducted on four-ten hour production shifts (Monday-Thursday) and three-thirteen hour shifts (Friday-Sunday). Mining is conducted 365 days per year.

Production Schedule. Since the issuance of the Draft EIS, Bowie has applied for approval from the Colorado DMG to increase annual coal production from 2 million to 5 million tons.

Area for Surface Facilities. Approximately 70 acres were disturbed for the construction of surface facilities for the Bowie No. 2 Mine. This includes the portal facilities, the haul road from the portal facilities to old State Highway 133, a utility corridor for a waterline and powerline, underground development waste rock (gob) facility, topsoil stockpile, and sediment control facilities. An estimated 10 to 15 acres will be needed for the installation of a new conveyor from the portal pad area to a location adjacent to old State Highway 133, the construction of a coal storage/truck loadout facility, and the related sediment control facilities.

Project Life. The project life of the Bowie No. 2 Mine would depend on the production rate from the operation. With the installation of a longwall system, assuming a coal production rate of 5 million tons per year, the remaining D coal seam reserves provide only about 1.5 years of operations without accessing the underlying B-seam.

Employment. With longwall mining techniques, the Bowie No. 2 Mine would employ an annual average of approximately 168 people.

Coal Transportation. At present, Bowie contracts its coal haulage to Savage Industries Inc. Coal is being hauled in highway trucks with a capacity of approximately 28 tons of coal from the Bowie No. 2 portal area to the Bowie No. 1 Loadout.

Upon completion of the new conveyor and the coal storage and truck loadout facility adjacent to old State Highway 133, the coal haulage distance would be shortened, but Savage Industries Inc. would continue to haul using their 28-ton trucks.

Employee/Supply Transportation. Access to the Bowie No. 2 Mine is via State Highway 133. See *Figure 1, General Location Map.*

Operational materials, consisting primarily of mine roof support materials (roof bolts and timber) fuel, and rock dust (finely-ground limestone), are delivered to the mine on a regular basis. These materials would be shipped from remote sources (Grand Junction, Salt Lake City, Denver).

Table 2-1, Materials and Supplies - Bowie No. 2 Mine, shows the estimated major consumable items to be used at the Bowie No. 2 Mine for a longwall mining operation with an annual production of 5 million tons of coal. This table includes the estimated fuel for transporting coal from the Bowie No. 2 Mine to the Bowie No. 1 Loadout.

Table 2-1
Materials and Supplies - Bowie No. 2 Mine
(@ 5 million tons per year)

Consumables	Daily Use	Annual Use	Physical Form	Truck Shipments	
				Weekly	Yearly
Roof Bolts (tons)	5	1,800	Steel	2	100
Fuel (gallons)	250	90,000	Liquid	0.25	14
Rock Dust (tons)	15	5,000	Powder	5	200
Timbers	120	40,000	Crib Blocks	2	100

Note: Numbers represent an annual production rate of 5 million tons of coal (longwall).

Water Use and Requirements. Water demand at the Bowie No. 2 Mine varies annually, seasonally, and even daily throughout the life of the operation. Presently Bowie has a variety of water rights including 0.5 cfs (362 acre-feet per year) from the Deer Trail Irrigation Ditch. Water withdrawals from the Deer Trail Ditch are used at the mine for varying operational needs such as surface dust control which is weather dependent. At present, the underground workings at the Bowie No. 2 Mine are essentially dry. Under normal usage, the Bowie No. 2 Mine uses approximately 59 acre-feet per year for mining purposes and approximately 6 to 7 acre-feet per year for domestic purposes.

Power Supply. Bowie obtains its electric power from the Delta-Montrose Electric Association. Bowie has a substation located along the existing distribution/transmission line in the North Fork of the Gunnison River Valley. Electricity is transmitted to the surface facilities via a powerline that has been constructed up the slope. The powerline has been designed to minimize any raptor electrocutions.

Reclamation. A discussion of reclamation appropriate to underground coal mines in Colorado is set forth in Section 2.9, Reclamation Measures.

2.3.3 Alternative A - No-Action Alternative - Elk Creek Coal Lease Tract

Under the No-Action Alternative, the Elk Creek Coal Lease Tract COC-61357 would not be offered for competitive sale at this time. For purposes of this EIS, the No-Action Alternative assumes that the federal mineable coal in the proposed lease area would not be mined.

If the decision would be not to lease, it is assumed for this EIS that Oxbow would continue its present mining of the B seam at the Sanborn Creek Mine and would still develop the Elk Creek portal area, which is located on private surface, in order to mine the D seam coal reserves from their fee (private) coal area.

The following discussion portrays the current activities of Oxbow should the No-Action Alternative be implemented for the Elk Creek Coal Lease Tract. This discussion serves as a baseline against which to compare the effects of action alternatives.

Project Location. The Sanborn Creek Mine and its related surface facilities are located immediately north and northeast of the community of Somerset, Colorado. The surface facilities are located on Oxbow's private lands north of State Highway 133, at an elevation range of approximately 6,000 to 6,100 feet. See *Figure 1, General Location Map*.

Nature of Coal and Coal Reserves. Oxbow is presently mining coal reserves from the B seam. In this area, the B seam thickness ranges up to 24 feet with an average mineable thickness of 10 to 14 feet.

The average run-of-mine coal quality for the B seam on an as-received basis is as follows:

BTU/Pound:	12,500
Moisture:	8-9%
Ash:	6-7%
Sulfur:	<0.5%

The Sanborn Creek Mine has approximately 8 to 12 million tons of mineable B seam coal within its approved permit area. Once the B seam coal reserves are extracted from the Sanborn Creek Mine, Oxbow plans to mine D seam reserves, on its fee lands adjacent to the Elk Creek Coal Lease Tract. In this area, the B and C seams have been previously mined by U.S. Steel Corporation (see *Appendix G, Historic Coal Mining Activity*). The D seam is approximately 250 to 300 feet above the B seam. There are approximately 4 to 5 million tons of D seam mineable coal on Oxbow's Elk Creek fee property.

The average run-of-mine coal quality analysis for the D seam on an as-received basis is expected to be:

BTU/Pound:	12,500
Moisture:	9-10%
Ash:	7-8%
Sulfur:	<0.5%

Surface Facilities. The Sanborn Creek Mine is an existing mining operation. The surface facilities consist of coal handling facilities, mine support facilities, sediment control structures, and other related facilities.

Coal mined from the Sanborn Creek operation is transported via surface conveyor from the portal facility to the Oxbow coal handling and loadout facility located immediately north of the town of Somerset, Colorado. This facility includes an existing unit train loadout.

Mining Techniques. The Sanborn Creek Mine utilizes a longwall system for coal extraction. A detailed discussion on longwall mining techniques is set forth in *Appendix F, Overview of Underground Coal Mining*.

Oxbow plans to utilize the longwall mining system to complete the B seam extraction in the Sanborn Creek Mine, then relocate the longwall system to recover D seam reserves from Oxbow's fee land located adjacent to the Elk Creek Coal Lease Tract.

Operating Schedule. The Sanborn Creek Mine operates three-eight hour shifts per day, seven days per week, 356 days per year. The mine has eleven holidays.

Production Schedule. The Sanborn Creek Mine is permitted with Colorado DMG to mine approximately 5 million tons of coal per year.

Area for Surface Facilities. Approximately 95 acres are utilized for Oxbow surface facilities. This includes the coal handling, crushing, and loadout facilities located immediately north of Somerset, as well as a hooded overland conveyor system to the portals of the Sanborn Creek Mine. These facilities also include miscellaneous items such as underground development waste rock (gob) engineered fills, topsoil stockpiles, and sediment control facilities.

Oxbow plans to open a new portal facility to be called the Elk Creek portal to be located on Oxbow's private lands. The Elk Creek portal would involve a total of approximately 25 acres (including about 10 acres of existing disturbance and 15 acres of new disturbance). The other existing Oxbow facilities, including the coal handling and loadout facilities, maintenance facilities, office, bath house, and other ancillary facilities would continue to be utilized for the proposed mining through the Elk Creek portal.

Development of the Elk Creek portal on Oxbow's fee property would occur concurrently with the longwall mining in the Sanborn Creek Mine. Once mining is exhausted in the Sanborn Creek Mine, the longwall system (shear machine, longwall shields, chain conveyor, etc.), would be transported from the Sanborn Creek Mine into the Elk Creek Mine. The Elk Creek Mine would simply represent a continuation of current operations at the Sanborn Creek Mine.

Project Life. At a production rate of 5 million tons per year, the mining life of the B seam coal reserves in the Sanborn Creek Mine is approximately 2 years. Adding the D seam fee coal on Oxbow's property adjacent to the Elk Creek Coal Lease Tract, an additional year of operation can be achieved.

Employment. In 1998, Oxbow had approximately 175 regular, full time employees, plus 40 contract miners, and 20 to 30 construction/contractor personnel.

Coal Transportation. Oxbow operates a unit train loadout at its existing facilities. Coal is transported from the underground operation to this unit train loadout via conveyor belt. In addition, Oxbow owns a fleet of coal hauling trucks, with a capacity of hauling 28 tons of coal per truck. These trucks are used to haul approximately 150,000 tons of coal per year to the Terror Creek Loadout, which is approximately 4 miles to the west of the Oxbow surface facilities at Somerset. This coal is sized for miscellaneous industrial and defense contracts, as well as for local domestic home heating uses. Coal can also be hauled to the Terror Creek Loadout from other mines in the North Fork Valley; see Section 1.9.5, Terror Creek Coal Loadout.

Employee/Supply Transportation. Access to the Oxbow operation is via State Highway 133.

Operational materials, consisting primarily of mine roof support materials (roof bolts and timbers), fuel, and rock dust (finely-ground limestone), are delivered to the mine on a regular basis. These materials would be shipped from remote sources (Grand Junction, Salt Lake City, Denver). Listed in *Table 2-2,*

Materials and Supplies - Oxbow Operation, are the estimated major consumable items that would be required for the Oxbow mines for the annual production rate of approximately 5 million tons of coal per year.

Table 2-2
Materials and Supplies - Oxbow Operation

Consumables	Daily Use	Annual Use	Physical Form	Truck Shipments	
				Weekly	Yearly
Roof Bolts (tons)	5	1,500	Steel	1	50
Timbers	100	30,000	Crib Blocks	1.5	75
Fuel (gallons)	800	250,000	Liquid	1.5	75
Rock Dust (tons)	10	3,000	Powder	2	100

Water Use and Requirements. Water demand at the Oxbow operation varies annually, seasonally, and even daily during mining operations. Presently, Oxbow has two water rights totaling 0.9 cfs (652 acre-feet per year) from the North Fork of the Gunnison River. Water withdrawals from the North Fork of the Gunnison River are used at the mine for surface and underground dust control and domestic uses, and also as a water source for the town of Somerset. Oxbow encounters water during its underground mining operations and discharges such inflows to the North Fork of the Gunnison River under an approved National Pollutant Discharge Elimination System Permit.

Power Supply. Oxbow obtains its electric power from the Delta-Montrose Electric Association. Oxbow maintains three substations located within its surface facilities near Somerset, Colorado, and downloads electricity from an existing distribution/transmission line in the North Fork of the Gunnison River Valley. A fourth substation would be added at the Elk Creek portal area.

Reclamation. A discussion of reclamation appropriate to the underground coal mines in Colorado is set forth in Section 2.9, Reclamation Measures.

2.4 ALTERNATIVE B - PROPOSED ACTIONS

2.4.1 Alternative B: Iron Point Exploration License

On May 12, 1998, an exploration license plan was submitted to the BLM by Bowie in accordance with 43 CFR 3410. The exploration license area is shown on *Figure 4, Iron Point Exploration Plan*. The area encompasses approximately 6,053 acres, primarily on National Forest System lands.

Exploration licenses can be granted for the exploration of unleased federal coal deposits. Pursuant to the Mineral Leasing Act of 1920, as amended, and to 43 CFR 3410, interested parties can participate with the original applicant in a program for exploration of unleased federal coal. Any party electing to participate in an exploration license program must share all costs on a pro rata basis with the applicant and with any other party or parties who elect to participate.

On June 17, 1998, the BLM published a Notice of Invitation in the Delta County Independent in accordance with 43 CFR 3410.2-1(c)(1) describing the exploration license plan area and inviting any parties who are interested to participate in the exploration program. Ark Land Company (an affiliate of Mountain Coal Company) elected to participate in this exploration program.

Holes would be rotary drilled to predetermined depths, cased as necessary, and the coal zone would be cored. Since the release of the Draft EIS, the applicant requested shifts on some of the drill hole locations. These proposed relocations were not received in time to analyze in the EIS, or for the public to review and comment on them. However, the EIS can examine the broader effects of exploration in the delineated license area, and can be relied upon to assess granting the license and approve specific hole locations originally submitted that were unchanged.

Exploration would be accomplished with one of the following methods:

- Air
- Air with water injection
- Water with synthetic polymer lubricant

Drilling would be accomplished with two types of rigs. The first, a truck mounted rotary such as a Gardner Denver 2000, and the second, a truck mounted Longyear 44 or equivalent. One mobile field office trailer, approximately 8x28 feet, would be used as a core logging facility and would be moved with the rig from location to location.

The drilling rigs would be accompanied by a 3,000-gallon water truck, a flatbed service truck, and smaller pick-up trucks as necessary for service and transportation to and from the drilling sites. A 10,000-gallon or similar water truck might be used as on-site storage to minimize the need for water trucks to travel over wet roads during inclement weather.

To further reduce water truck traffic on dirt roads, water would also be pumped to certain drill hole locations, or a central storage point, via high pressure hoses. A pump would be placed in a horse trough and located adjacent to certain stock water ponds or Hubbard Creek. The horse trough would prevent any oil, grease, or fuel from escaping to the water source. One pump site on Hubbard Creek would require helicopter transport of the pump and horse trough.

Some or all of the drill holes may be geophysically logged. The equipment necessary for such work is typically mounted in a full size Suburban-type 4x4.

To the extent possible, existing roads would be used for access and, where available, disturbed sites (wide spots, borrow pits, etc.) would be utilized for drilling sites. Some drill holes may require helicopter access. Approximately 2 miles of access roads may be required if all 25 holes shown on *Figure 4, Iron Point Exploration Plan*, are drilled. With these access roads, it is estimated that 2 to 3 acres would be affected. These new roads would be temporary, for drilling access only, and would be reclaimed in accordance with applicable BLM and Forest Service standards for temporary access roads and in compliance with performance standards of the Colorado DMG for light use roads. Each individual drill pad would require about 0.25 acres of surface disturbance. For 25 drill holes, an estimated 6.25 acres would be affected. In total, disturbance from exploration activities would be less than 10 acres.

Roads would be constructed using a Caterpillar D-9 class dozer, or equivalent, or smaller track-mounted dozers, and a proportionately sized backhoe such as a John Deere 410C. Most existing roads were constructed originally for coal exploration purposes, but they may require regrading, replacement of culverts, etc., for renewed drilling access use. A backhoe and/or a motor grader would be adequate to assist with this minor maintenance work.

The applicant contemplates completion of two exploration drill holes, identified as IP99-8 and IP99-10, for future groundwater monitoring wells. See *Figure 4, Iron Point Exploration Plan*.

Drilling and access road/site preparation work would begin as soon as possible after an exploration license is granted, weather permitting and in compliance with wildlife stipulations. Drilling and geophysical logging activities must occur within the two-year period allowed for under exploration license approvals.

Exploration drill hole plugging and sealing would be contemporaneous with the drilling program. When no longer needed for any drilling or geophysical logging activities, the drill sites would be reclaimed. Reclamation for exploration activities would consist of plugging and capping drill holes, recontouring drill pads, rehabilitating mud and covering sumps, redistributing topsoil, and revegetating disturbed sites with grasses and shrubs. Experience shows that drill pads reclaim within 3 to 5 years.

Exploration activities would be controlled by Forest Service surface use stipulations. See *Appendix I, Forest Service Stipulations - Iron Point Coal Lease Tract (C-61209).*

Any exploration would also comply with the rules and regulations regarding exploration. Any surface disturbing activities associated with the exploration license area would also be subject to reclamation bonding by the appropriate agencies.

2.4.2 Alternative B - Offer Iron Point Coal Lease Tract as Applied for by Applicant

This action alternative would offer the Iron Point Coal Lease Tract for competitive leasing. The tract would contain approximately 3,403 acres of federal coal in the Iron Point Tract, with an estimated 24 million tons of recoverable D coal seam reserves. Based on the unsuitability criteria discussed in *Appendix C, Unsuitability Analysis Report - Iron Point Coal Lease Tract (C-61209),* mining would be restricted or limited under the Curecanti-Rifle 230/345kV electric transmission line.

The reasonably foreseeable development scenario for the Iron Point Tract is discussed in Section 2.2, Formulation of Alternatives.

The following presents additional information regarding the Iron Point Coal Lease Tract:

Project Location. See *Figure 5, Alternative B.*

Nature of Coal and Coal Reserves. The coal reserves are in the D seam of the Mesa Verde Formation. An original estimate of 24 million tons of recoverable reserves are contained within this lease tract for the D seam. In addition, the lease tract would provide for access to the “Bowie No. 1 pod” (Federal Coal Lease C-37210), which contains an estimated 10 million tons of remaining coal reserves. See *Figure 3, Historic Coal Mines and Federal Coal Lease Locations.*

Surface Facilities and Equipment. The existing surface facilities of the Bowie No. 2 Mine would be used, along with the planned construction of a new overland, covered conveyor, and a coal storage/truck loadout facility on private property. The coal storage and loadout facility would be adjacent to old State Highway 133. The lessor may establish several improvements on the lease tract, including an exhaust shaft in the Hubbard Creek drainage and degasification boreholes (one assumed for each proposed longwall panel). To the extent possible, existing roads would be used for the ventilation shaft and degasification boreholes.

Mining Techniques. Longwall mining would be planned for the lease.

Operating Schedule. Same as currently undertaken by Bowie No. 2 Mine. See Section 2.3.2, No-Action Alternative - Iron Point Coal Lease Tract (COC-61209).

Production Schedule. A projected 5 million tons of coal per year could be extracted from the lease. The actual tonnage could be less, dependant on market conditions.

Area for Additional Surface Facilities. Other than possibly three exhaust shafts and degasification boreholes, and the access to these locations, no new surface disturbance is planned. Disturbance for an individual exhaust shaft would be less than 1 acre. Similarly, degasification boreholes would be similar to exploration drill holes, averaging less than 0.25 acre of disturbance per site. However, depending on where the exhaust shafts and degasification boreholes are located, there could be additional disturbance associated with access road construction to the sites. Existing access roads would be used to the extent practicable.

Project Life. At 5 million tons of coal per year of production, the project life for extraction of coal would be approximately 7 years of operation. However, at reduced production, the project life would be extended.

Employment. An operation involving longwall mining of the coal in the Iron Point Coal Lease Tract would employ an estimated 168 people.

Coal Transportation. Coal would be transported via the newly constructed conveyor to a coal storage/truck loadout facility near old State Highway 133. These facilities are located on private ground. The coal would then be trucked to the Bowie No.1 unit train loadout.

Employee/Supply Transportation. The same as Alternative A. See Section 2.3.2, No-Action Alternative - Iron Point Coal Lease Tract (COC-61209).

Water Use and Requirements. Generally the same as Alternative A. See Section 2.3.2, No-Action Alternative - Iron Point Coal Lease Tract (COC-61209). Water use for mining purposes is estimated to be approximately 45 acre-feet per year as a result of longwall production.

Power Supply. Same as Alternative A. See Section 2.3.2, No-Action Alternative - Iron Point Coal Lease Tract (COC-61209).

Reclamation. Same as Alternative A. See Section 2.3.2, No-Action Alternative - Iron Point Coal Lease Tract (COC-61209).

2.4.3 Alternative B - Offer Elk Creek Coal Lease Tract as Applied for by Applicant

This action alternative would offer for competitive lease approximately 3,863 acres of federal coal in the Elk Creek Coal Lease Tract, containing approximately 21 million tons of D coal seam recoverable reserves.

The mine plan presented under this reasonably foreseeable development scenario was developed from a mine plan submitted by Oxbow in their coal lease application. This plan would represent a logical extension of current Oxbow mining operations into the Elk Creek Coal Lease Tract.

This proposed action scenario is used to estimate the surface impacts of mining the coal on the Elk Creek Coal Lease Tract. This reasonably foreseeable development scenario anticipates that the Elk Creek portal would be constructed on Oxbow's Elk Creek fee lands to gain access to Oxbow's Elk Creek fee coal, followed by access to the Elk Creek Coal Lease Tract.

The following presents information regarding the Elk Creek Coal Lease Tract:

Project Location. See *Figure 1, General Location Map*.

Nature of Coal and Coal Reserves. An estimated 21 million tons of recoverable reserves are contained within this lease tract for the D seam.

Surface Facilities and Equipment. In order to develop the Elk Creek Coal Lease Tract, Oxbow plans to open a new portal to be called the Elk Creek portal and mine their fee coal. This portal would be located on Oxbow's private lands to the south of the Elk Creek Coal Lease Tract. The existing surface facilities used for the Sanborn Creek Mine would continue in use for the Elk Creek Mine operation while mining their fee coal. These facilities would probably also be used to handle the coal mined from the Elk Creek Coal Lease Tract, regardless of the successful bidder.

There are no portals or other surface facilities to be located on the Elk Creek Coal Lease Tract. All surface facilities would be located on fee lands adjacent to the Elk Creek Coal Lease Tract, with the possible exception of a ventilation shaft in the Bear Creek drainage and 16 degasification boreholes (one assumed for each longwall panel). To the extent practicable, existing roads would be used to gain access to any future shaft and/or degasification boreholes.

Mining Techniques. Longwall mining would be planned for the lease.

Operating Schedule. Same as currently undertaken by Oxbow for the Sanborn Creek Mine. See Section 2.3.3, No-Action Alternative - Elk Creek Coal Lease Tract (COC-61357).

Production Schedule. An average of 5 million tons of coal per year is planned to be extracted from the Elk Creek Coal Lease Tract.

Area for Additional Surface Facilities. Disturbance for a ventilation shaft would be less than 1 acre. Similarly, the potential 16 degasification boreholes would be similar to exploration drill holes, averaging less than 0.25 acre of disturbance per site. These acreage figures do not include possible road access to the sites. Depending on the ability to use existing access roads, access roads might be needed to gain access to the ventilation shaft and the degasification boreholes.

Project Life. At an average of 5 million tons per year of coal production, the project life for extraction of the D coal seam from the Elk Creek Coal Lease Tract (in addition to the fee coal mined on Oxbow property) would be 6 to 10 years.

Employment. An operation involving longwall mining of the coal in the Elk Creek Coal Lease Tract would employ an estimated 190 to 215 people.

Coal Transportation. Same as Alternative A. See Section 2.3.3, No-Action Alternative - Elk Creek Coal Lease Tract (COC-61357).

Employee/Supply Transportation. Same as Alternative A. See Section 2.3.3, No-Action Alternative - Elk Creek Coal Lease Tract (COC-61357).

Water Use and Requirements. Same as Alternative A. See Section 2.3.3, No-Action Alternative - Elk Creek Coal Lease Tract (COC-61357).

Power Supply. Same as Alternative A. See Section 2.3.3, No-Action Alternative - Elk Creek Coal Lease Tract (COC-61357).

Reclamation. Same as Alternative A. See Section 2.3.3, No-Action Alternative - Elk Creek Coal Lease Tract (COC-61357).

2.5 ALTERNATIVE C - MULTI-SEAM MINING AND ADJUSTED COAL LEASE BOUNDARIES

2.5.1 Alternative C - Iron Point Exploration License

Same as proposed for Alternative B. See Section 2.4.1, Proposed Action - Iron Point Exploration License.

2.5.2 Alternative C - Offer Iron Point Coal Lease Tract for Multi-Seam Mining

This action alternative would offer the Iron Point Coal Lease Tract for competitive leasing with both the D and B seams available for mining. The lease boundaries would be slightly widened in the area along Terror Creek to allow adequate room for underground access entries to be driven from the Iron Point Coal Lease Tract under Terror Creek to the coal in the Bowie No. 1 pod, which contains approximately 10 million tons of coal. See *Figure 6, Alternative C.*

With the expansion of the lease boundaries from those delineated for Alternative B, the Iron Point Coal Lease Tract under Alternative C would encompass approximately 3,643 acres, with an original estimate of 24 million tons of recoverable D coal seam reserves and an estimate of 17 million tons of recoverable B coal seam reserves. As with Alternative B, any mining as contemplated under Alternative C would be restricted or limited under the Curecanti-Rifle 230/345 kV electric transmission line.

The multi-seam development scenario contemplated under Alternative C would entail mining both the D and B coal seams within the Iron Point Coal Lease Tract. The B coal seam would be accessed by an underground rock slope from the overlying D coal seam. Coal mined from the B seam would be transported from the underground workings to the existing Bowie No. 2 surface coal handling and loadout facilities.

At a projected 5 million tons of coal per year of production, the project life for this alternative is 9 to 10 years.

The other aspects of the mining for the Iron Point Coal Lease Tract would essentially be the same as presented for Alternative B. See Section 2.4.3, Alternative B - Offer Iron Point Coal Tract as Applied for.

2.5.3 Alternative C - Offer Elk Creek Coal Lease Tract with Revised Boundary

This action alternative would offer for competitive lease approximately 4,296 acres of federal coal in the Elk Creek Coal Lease Tract, containing approximately 23 million tons of D coal seam recoverable reserves. Under this alternative, the western boundary of the Elk Creek Coal Lease Tract would be adjusted to coincide with the eastern boundary of the Iron Point Coal Lease Tract. See *Figure 6, Alternative C.*

The development plans for the Elk Creek Tract would essentially be the same as presented for Alternative B; however, it might be possible to extract additional coal within the expanded western boundary area. This expanded boundary would add approximately 2 million tons of coal to the lease tract. By joining the lease tracts, access might be possible from one lease to another.

The other aspects of the reasonably foreseeable development would be the same as under that described for the Elk Creek Mine in Alternative B. See Section 2.4.3, Alternative B - Offer Elk Creek Coal Lease Tract as Applied for.

2.6 ALTERNATIVE D - NO SUBSIDENCE IN SENSITIVE AREAS

Alternative D is the Agency Preferred Alternative. Of the action alternatives, this is also the environmentally preferred alternative.

2.6.1 Alternative D - Iron Point Exploration License

Same as proposed for Alternative B. See Section 2.4.1, Proposed Action - Iron Point Exploration License.

2.6.2 Alternative D - Offer Iron Point Coal Lease Tract With Stipulation That There be No Subsidence in Sensitive Areas

This action alternative would offer the Iron Point Coal Lease Tract for competitive leasing as proposed in Alternative C. The only difference would be the strict stipulation that there would be no subsidence under either Terror Creek or Hubbard Creek, nor any subsidence under the Curecanti-Rifle 230/345 kV electric transmission line.

Based on continuing geologic analysis for the area, since the issuance of the Draft EIS, the boundaries of the proposed Iron Point Coal Lease Tract have been modified as shown in *Figure 2-1, Modified Iron Point Coal Lease Tract - Alternative D.* It appears that the B and D coal seams thin and split into seams of unmineable thickness toward the northwest part of the tract. In addition, the continuing analysis indicates that the igneous intrusions may have "burned" portions of the B and D coal seams, leaving no mineable coal. Based on this re-evaluation of the lease tract, there are approximately 5 million tons of coal less in Alternative D than originally estimated in the Draft EIS. The realignment of the boundary also provides additional protection to Terror Creek Ditch and Reservoir. Other aspects of Alternative D would be the same as proposed for Alternative C.

2.6.3 Alternative D - Offer Elk Creek Coal Lease Tract With Stipulation That There be No Subsidence in Sensitive Areas

This action alternative would offer the Elk Creek Coal Lease Tract for competitive leasing as proposed in Alternative C. The only difference would be the strict stipulation that there would be no subsidence under Hubbard Creek. Within this subsidence stipulation, approximately 2 million tons of coal would be removed from the recoverable reserve estimate for the lease tract as compared to Alternative C.

The agencies have slightly modified the Elk Creek Coal Lease Tract boundary based on comments received on the Draft EIS. The revision would add approximately 55 acres in the southeast corner. See *Figure 2-2, Modified Elk Creek Lease Tract - Alternative D.* This addition adds flexibility to possible ventilation designs to improve worker health and safety and prevent sterilization of coal. Other aspects of Alternative D would remain the same.

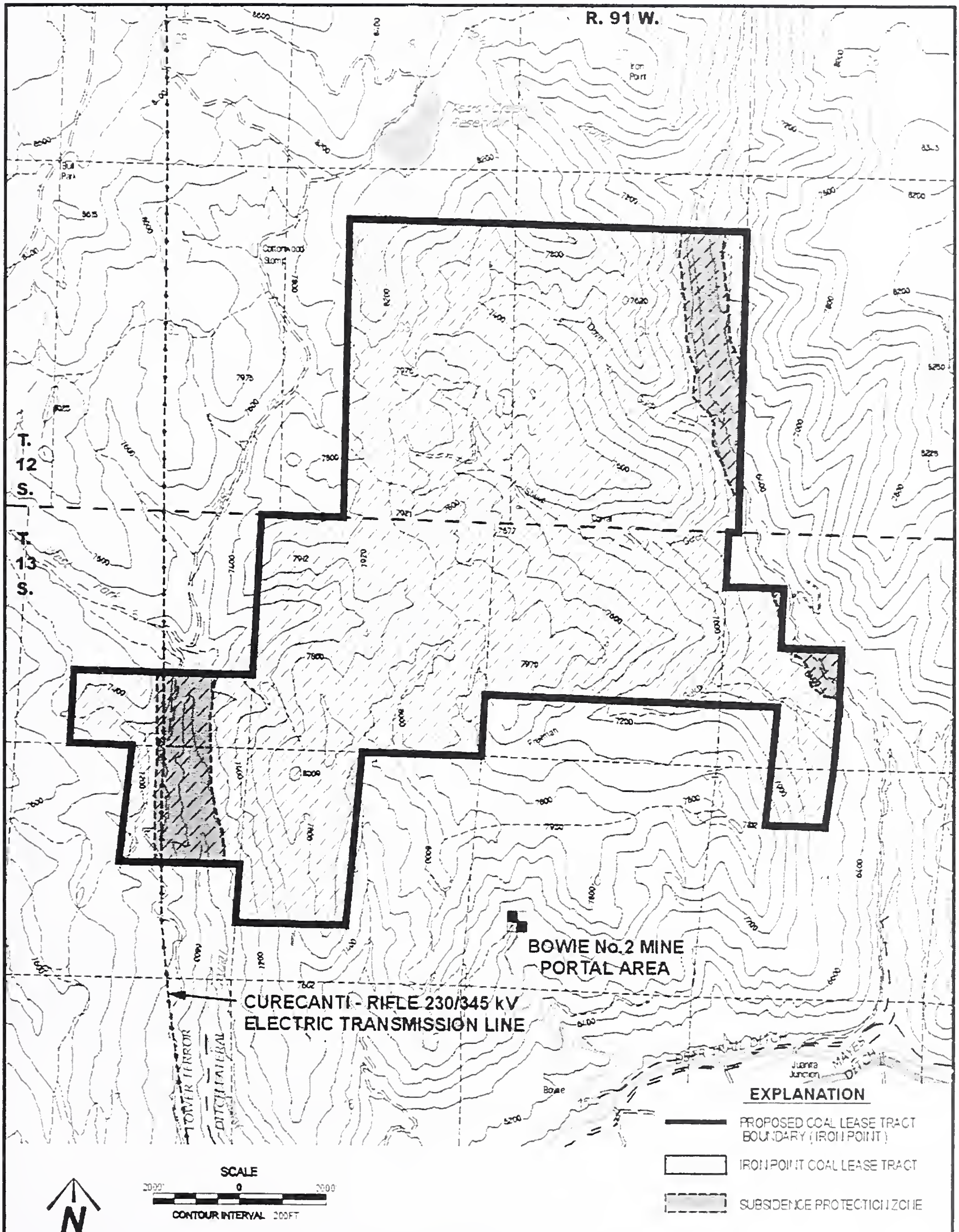


FIGURE 2-1
MODIFIED IRON POINT COAL LEASE TRACT - ALTERNATIVE D

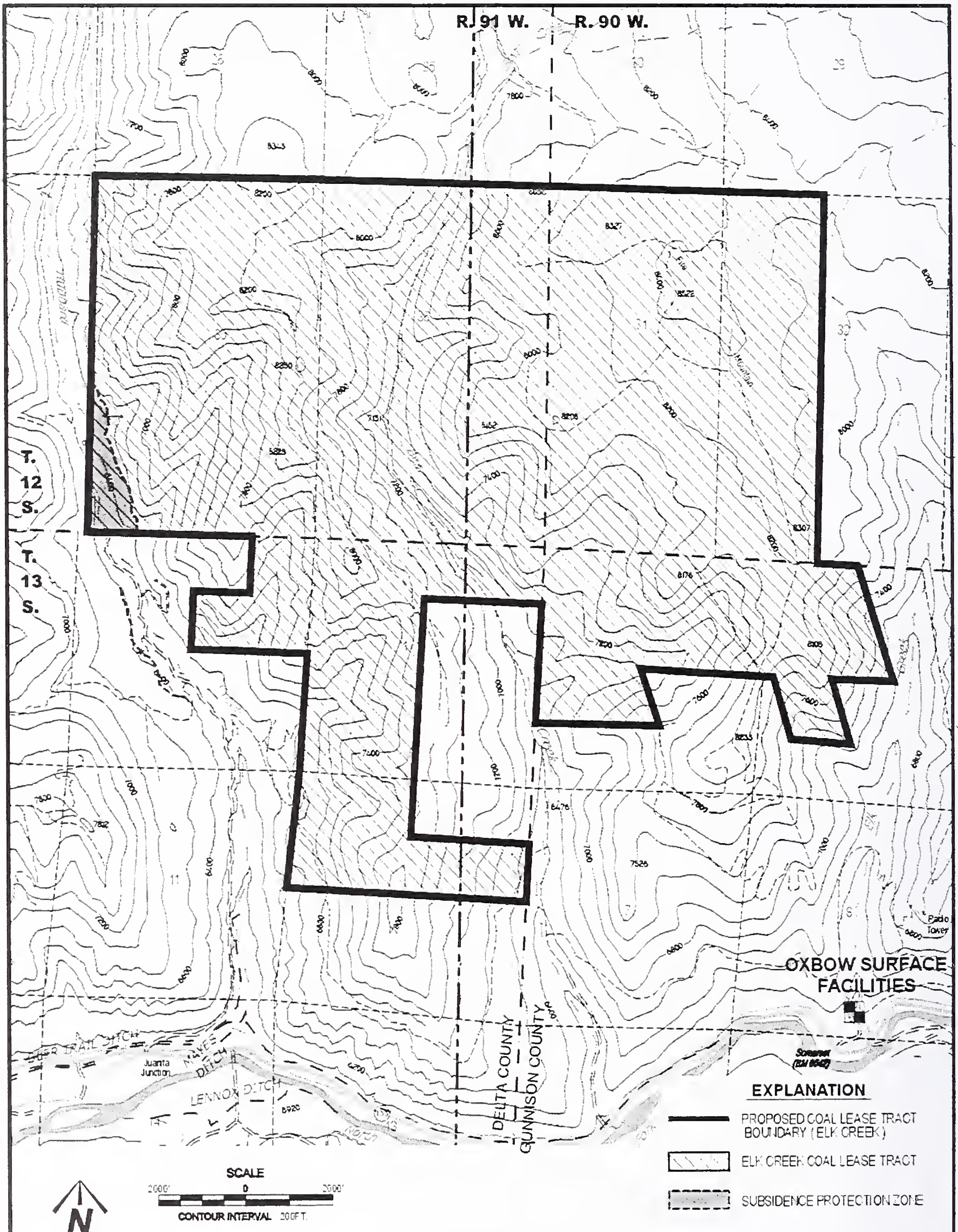


FIGURE 2-2
MODIFIED ELK CREEK COAL LEASE TRACT - ALTERNATIVE D

2.7 TRANSPORTATION OPTIONS

Transportation attracted considerable attention and comments. In particular, there were two main issues:

1. Coal truck traffic from the Bowie No. 2 Mine to the Bowie No. 1 Loadout; and,

2. The impacts of increased railroad traffic and the ability of the Union Pacific Railroad to handle increased coal tonnage from the mines in the North Fork of the Gunnison River Valley.

Possible options to coal truck traffic from the Bowie No. 2 Mine to the Bowie No. 1 Loadout include the following:

- No-Action Alternative (not lease the Iron Point Coal Lease Tract)
- Limited production on Iron Point Coal Lease Tract
- Increase capacity of highway trucks hauling the coal
- Build a new railroad loadout at Bowie No. 2 Mine to replace the Bowie No. 1 Loadout
- Build a stand-alone haul road from Bowie No. 2 Mine to the Bowie No. 1 Loadout and utilize off-highway haulers
- Build a conveyor from Bowie No. 2 Mine to the Bowie No. 1 Loadout

Railroad options would include an examination of the No-Action Alternative and the impacts of various levels of total coal production shipped by rail from the North Fork of the Gunnison River Valley.

In response to public input and public interest, the BLM and Forest Service decided to examine these transportation options in Section 3.14, Transportation. The BLM and the Forest Service recognize that these transportation options exist with differing economic and legal implications. The lead agencies decided that it was in the public interest to discuss these options and the various impacts/benefits that might occur with the implementation of such options.

During the scoping process, representatives from the Colorado Department of Transportation did not indicate any problem with State Highway 133 handling the projected increased coal truck traffic. In addition, a representative from the Union Pacific Railroad also voiced his opinion that the existing railroad can handle increased coal tonnage from the mines in the North Fork Valley. Section 3.14, Transportation, has been further modified based on input received on the Draft EIS.

Since the release of the Draft EIS, representatives from Bowie have indicated the likelihood that the firm would construct a new train loadout adjacent to the Bowie No. 2 Mine, if they are the successful bidder for the Iron Point Coal Lease Tract. Construction of a new train loadout would mean less truck traffic on State Highway 133; however, there would remain coal truck traffic to the Terror Creek Loadout from other mines, and the possibility that some coal could be trucked from the North Fork Valley to serve potential industrial and electrical power customers in western Colorado.

2.8 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED EVALUATION

2.8.1 Offer Iron Point and Elk Creek Coal Lease Tracts Without Stipulations

This alternative would not include any standard and/or special coal lease stipulations for the protection of non-coal resources such as wildlife, soils, water, etc. This alternative was not analyzed because it would be inconsistent with BLM and Forest Service land-use plans. Environmental impacts resulting from this alternative could cause material damage of resources.

2.8.2 Room-and-Pillar Mining (no Longwall Mining) of the Iron Point and Elk Creek Coal Lease Tracts

The impacts of room-and-pillar mining were not assessed for the Iron Point or Elk Creek Coal Lease Tracts. This alternative was considered but not analyzed given the current reasonable expectation that the coal in both leases would be recovered by longwall mining techniques, which maximizes resource recovery and is the trend for mining in the North Fork of the Gunnison River Valley. If a successful lessee decides that mining should be completed solely by room-and-pillar methods, it might be necessary to undertake additional environmental analysis to determine mining impacts, especially the subsidence potential, which would be different than longwall-induced subsidence.

2.8.3 Surface Mining of the Iron Point and Elk Creek Coal Lease Tracts

Surface mining of the coal in the Iron Point and Elk Creek Coal Lease Tracts would neither be economically or environmentally preferable due to topographic and geologic conditions.

2.8.4 Limit the Size of the Iron Point Coal Lease Tract to Avoid Coal Beneath Terror Creek and Curecanti-Rifle 230/345 kV Electric Transmission Line

An alternative, discussed in the environmental assessment prepared for the Iron Point Coal Lease Tract, would have adjusted the lease boundaries to eliminate area from the lease under Terror Creek and the Curecanti-Rifle 230/345 kV electric transmission line, as well as adding a 1 mile buffer zone from the Terror Creek Reservoir. The purpose of these restrictions was to prevent any subsidence from impacting these facilities.

In limiting the size of the Iron Point Coal Lease Tract, and precluding any mining access beneath Terror Creek, access to the coal reserves in federal coal lease COC-37210 could be realized only via the existing Bowie No. 1 Mine or by re-opening and rehabilitating the now abandoned Farmer's Mine. It should be noted that such actions would only be speculative at this point, as no formal permit applications or requests for such actions have been submitted to the Colorado DMG or other regulatory agencies.

Accessing the federal coal reserves in lease COC-37210 through the existing Bowie No.1 Mine would be expensive and also extremely difficult given the dangers and hazards that such an undertaking might involve rehabilitating through the area in the mine ravaged by a 1986 mine fire. Perhaps, such a rehabilitation would not be allowed by the Mine Safety and Health Administration.

Re-opening and rehabilitation of the old Farmer's Mine would have its own set of impacts and expenses. A new portal area with its associated surface facilities would have to be constructed. The access roads to the site would have to be upgraded. Travel and coal transportation in the Garvin Mesa area would be increased dramatically, causing safety, dust and noise impacts to area residents.

Because subsidence protection for the Curecanti-Rifle 230/345 kV electric transmission line is considered in all action alternatives, and a subsidence protection zone is considered under Terror Creek as part of Alternative D, it was determined that an alternative of further reducing the size of the Iron Point Coal Lease Tract was not necessary simply based on subsidence protection. The size reductions from the previous environmental assessment were negotiated between Bowie and private interests. To the agencies knowledge, the reductions were not based on any in-depth analysis. The action alternatives effectively address the relevant issue of subsidence.

2.9 RECLAMATION MEASURES

Regulations and policies of the BLM, Forest Service, and Colorado DMG require reclamation. Areas disturbed by coal exploration and mining operations in the state of Colorado must be returned to a stabilized and productive condition following the exploration and mining. The goal of reclamation is to protect long-term land, water, and air resources in the area. Lands disturbed by coal exploration and mining operations must be returned to productive land uses consistent with land management policies.

Any coal exploration and mining activities within the state of Colorado must receive approval of reclamation measures from the Colorado DMG. Similarly, for coal exploration and mining activities on federal lands administered either by the BLM or the Forest Service, reclamation plans for any disturbed sites must be submitted to and approved by the BLM and/or Forest Service. The OSM, a federal agency with oversight on coal exploration and mining, provides oversight of the Colorado DMG and cooperates with the BLM and Forest Service when federal coal is involved in either exploration or mining. Specific reclamation plans are part of the PAP submitted to Colorado DMG.

Any reclamation plans approved for the Iron Point Exploration License Area and for mining on or associated with the Iron Point or Elk Creek Coal Lease Tracts would be required to describe measures to reduce long-term impacts at the disturbed sites, with the goal to return any disturbed land to a productive state similar to that which existed on the site prior to exploration or mining disturbance.

It should be noted that reclamation practices and technology are changing and developing. There could be future modifications in reclamation plans as techniques and materials are refined or developed. Any applicant for an exploration license or lessee of a federal coal tract would certainly be encouraged to take advantage of opportunities to explore new reclamation techniques and new methods for erosion control. Reclamation plans for coal mining operations are reviewed every 2.5 years and would be updated at least once every 5 years or as appropriate to consider improvements in reclamation technology.

Any reclamation programs for the Iron Point Exploration License Area and the Iron Point and Elk Creek Coal Lease tracts would be designed to reclaim exploration and/or mine related disturbance in compliance with the requirements of the applicable regulatory agencies.

2.9.1 Reclamation Goals and Objectives

The current land use of the Iron Point Exploration License Area and the Iron Point and Elk Creek Coal Lease tracts is primarily livestock grazing, wildlife habitat, and dispersed recreation. Some of the area in the general vicinity of the exploration license and coal lease tracts has previously been harvested for timber (aspen).

The reclamation plan for any disturbances associated with any of the alternatives would incorporate the following basic goals:

- Establishment of stable surface, topographic, and drainage conditions that are compatible with the surrounding landscape and that control erosion, water quality, and air quality impacts;

- Establishment of surface soil conditions that are conducive to regeneration of a stable plant community through removal, stockpiling, and re-application of suitable topsoil and cover soil material;

- Revegetation of disturbed areas using species adapted to site conditions in order to establish a long-term productive, self-sustaining, biotic community compatible with currently identified land uses and comparable with what currently exists on the site; and,

- Consideration of public safety including posting warning signs, limiting public access, and stabilizing or removing structures created as a result of mining activities that could constitute a public hazard.

2.9.2 Reclamation Schedule

Closure and reclamation measures would be incorporated into exploration and mine permits, and they would be an integral part of any exploration and mining approval by the BLM, Forest Service, and the Colorado DMG.

Reclamation activities would be initiated as soon as reasonably feasible following completion of any exploration or mining related disturbance in a particular area if the area is not going to be used for some ongoing or proposed future operation. One of the fundamental objectives of reclamation is to minimize erosion and sedimentation problems. In general, reclamation activities would be timed to take advantage of optimal climatic conditions. Seed beds would be prepared, and seeding would be completed in order to take advantage of seasonal moisture.

Interim reclamation would be employed to reduce erosion and the potential for water quality degradation. Interim reclamation refers to reclamation efforts on lands disturbed during the course of a project. It is used to temporarily stabilize an area prior to final reclamation. Interim reclamation would include revegetation to reduce erosion and sedimentation during the life of a project. Topsoil would not be applied to interim revegetation areas. Mulch would be applied, as appropriate, following seeding. The areas which would require interim reclamation would include temporary road embankments and topsoil stockpiles.

Most reclamation activities for an exploration project and underground mining operation would occur on completion of the use of an exploration drill hole site and at final mine closure and would be considered permanent, or final, reclamation. The areas to undergo reclamation at the completion of an exploration program would include drill pads and roads not needed for some future ongoing use. For mine closure, reclamation would involve the portal facility areas, coal waste rock disposal areas, borrow sites, roads, and other ancillary areas. Final reclamation for an underground coal operation would begin upon permanent cessation of mining activities for the associated coal reserve area.

Temporary Cessation. Although a temporary cessation of operations is generally not planned, circumstances beyond the control of applicants may require temporary cessation of operations at either mine site. Cyclical production trends or slow-downs are unpredictable because they are due to a combination of circumstances including expiration of coal contracts, fluctuation in coal prices, labor disputes or costs, production costs, taxes, company profitability, and effects of national, political and economic events.

In the event of a temporary cessation of coal mining activities, mine operators would notify the BLM, Forest Service, OSM, and Colorado DMG of the temporary curtailment of mining activities. This notification would include reasons for the shutdown and estimated time frame for resuming production, as well as ongoing maintenance and monitoring measures to be employed during the temporary cessation of operations. As an example, the Bowie No. 1 Mine is currently in temporary cessation.

During any temporary shutdown, operational and environmental maintenance activities would continue, to assure the site meets all permit and lease stipulations and requirements for environmental protection. Environmental monitoring requirements would continue on defined schedules, as outlined

in lease stipulations and appropriate permit approvals. Environmental reports would be submitted in a timely manner. Regardless of the operating status of the mining, appropriate monitoring would be continued until compliance with all permanent closure requirements was attained, unless modified by the appropriate regulatory authorities.

Permanent Cessation. In the unlikely event that mining activities permanently cease prior to the scheduled completion of operations, environmental impacts related to such operations may be less than originally envisioned, although socioeconomic impacts may be magnified. If operations cease prematurely, the mine operators would work with the appropriate agencies, as necessary, to revise the reclamation plan in order to specifically address the existing conditions at the time of closure.

2.9.3 General Reclamation Practices

Coal exploration and mining operators are responsible for the following general steps in reclaiming disturbed areas:

- Decommissioning of facilities
- Removal of structures
- Portal closing and sealing
- Sealing and plugging drill holes
- Recontouring and regrading
- Topsoil replacement
- Topsoil sampling and fertilization
- Permanent revegetation
- Mulching
- Reclamation maintenance and monitoring

Each of these steps is described in the following sections.

Decommissioning of Facilities. Unless a beneficial alternative post-mining land use is approved, following completion of an exploration project and the permanent cessation of a coal mining operation, all equipment, instrumentation, furniture, etc. would be removed from the site or disposed of in a manner acceptable to and approved by the Colorado DMG.

Removal of Structures. Unless a beneficial alternative post-mining land use is approved, all structures and facilities used for exploration or mining activities would be dismantled and/or removed from the site at the time of project completion or permanent operation closure. This includes temporary trailers, the portal facility complex, the coal handling and loadout facilities, electric power facilities such as powerlines and substations, shops, warehouses, office buildings, etc.

Portal Closing and Sealing. At the permanent cessation of underground coal mining activities, all portal entries and ventilation raises or shafts would be permanently sealed. Permanent closure measures would be designed and implemented to prevent access to the mine workings by people, livestock, fish and wildlife, machinery, and to keep possible or potential acid or other toxic drainage from entering ground and/or surface waters.

Sealing and Plugging Drill Holes. Exploration holes, drill holes, boreholes, and wells not completed to aquifers would be sealed by replacing cuttings in the hole and placing a suitable plug 10 feet below the ground surface to support a cement plug to within 3 feet of ground surface, unless otherwise authorized by the land managing agency and/or the Colorado DMG.

Exploration holes, drill holes or boreholes, or wells completed in aquifers would be sealed using bentonite, cement or other suitable sealant, by placing the sealant in the hole from the bottom to within

10 feet of the ground surface. Final sealing of the hole would be accomplished as stated in the first paragraph of this section.

Recontouring and Regrading. The portal facility areas and other disturbed areas would be recontoured and regraded as appropriate to achieve an acceptable post-mining topography. During this phase of project closure, high traffic areas such as roads would be ripped to alleviate compaction. Post-mining surface drainage patterns would be re-established.

Topsoil Replacement. Following regrading activities, disturbed sites would be covered with topsoil material or suitable substitute. Such topsoil or other suitable material would be replaced to serve as a rooting zone for revegetation. Soil amendments would be incorporated, as needed, to aid in revegetation.

All sites would be stabilized to maintain safe working conditions by regrading along the contour, applying topsoil material along the contour, and/or leaving the regraded surface in a roughened configuration to resist wind, water erosion and maximize soil water retention. Surface manipulation treatments such as ripping and chiseling along the contour, contour furrows, and/or contour terraces would be employed and/or constructed in areas likely to develop rills and gullies and in heavily compacted areas.

Permanent Revegetation. Reseeding would be conducted on disturbed sites with a seed mixture used for permanent revegetation. Reseeding would be conducted by appropriate application methods such as broadcast-seeding, drill-seeding, or hydro-seeding.

Mulching. As required for initial stabilization, erosion control materials such as wood fiber mulch, straw, or erosion control/mulch blankets would be applied in a separate step following seeding. Such mulching practices would be employed as necessary to reduce initial erosion and sedimentation.

Reclamation Maintenance and Monitoring. Newly reclaimed areas would be managed consistent with reclamation goals. The sites would be examined periodically during the first several years after revegetation to determine the effectiveness of the reclamation program. The success of revegetation would be monitored to ensure erosion was prevented and that species re-establishment was occurring. Maintenance would be conducted on the site as necessary to assure site stability and the establishment of the preferred plant species.

2.9.4 Reclamation Performance Securities

The statutory and regulatory authority of the BLM, Forest Service, OSM, and the Colorado DMG requires the submittal of reclamation performance securities (bonds) to assure that adequate reclamation and restoration of disturbed areas are achieved following exploration and mining activities. The bond would assure that sufficient monies are available to properly reclaim areas disturbed and/or to conduct monitoring or other activities in the event that the exploration or mine operator was unable to meet their reclamation obligations. A bond is a financial guarantee that would be forfeited to the appropriate agency should the operator abandon the site and fail to properly reclaim the site. A bond would provide the agency with sufficient funds to complete the necessary reclamation.

No exploration or mining operations can commence without the execution of a reclamation bond with the applicable agencies responsible for reclamation of the sites.

2.10 MANAGEMENT AND MITIGATION

Existing federal and state rules and regulations require extensive mitigation and monitoring to mitigate the environmental consequences associated with coal exploration or mine operation.

Management and mitigation practices are based on federal, state, and local laws and regulations, current technology, and best management practices. The objectives of these management and mitigation practices would be to reduce or avoid adverse impacts to the environment and to reclaim disturbed areas. Implementation of management and mitigation measures would primarily be the responsibility of the exploration proponents or mine operators. Enforcement of management and mitigation measures would be within the jurisdiction of the governmental agencies issuing permits and approvals for such coal exploration or mining activities.

Mitigation measures are either required or proposed in the BLM Unsuitability Criteria Analysis, the Forest Service Standard Stipulations, or Chapter 3.0, Environmental Analysis. Depending on one's perception and resource capabilities, all measures would have a moderate to high degree of effectiveness in mitigating impacts. Final mine plans submitted for mine permit approval will be designed and reviewed to ensure they address site specific requirements and conditions and thereby increase the effectiveness of the mitigation measures.

2.11 MONITORING MEASURES

Environmental monitoring programs that meet the requirements of the BLM, Forest Service, and the Colorado DMG would be implemented and maintained as part of mining activities. Monitoring would determine the effects of the mining and the efficiency of mitigation measures. Monitoring would also provide valuable input to governmental agencies regarding project performance. The information gained during monitoring would be used as the basis for designing additional mitigation measures, if necessary. The effects analyses in Chapter 3.0, Environmental Analysis, incorporate the monitoring that will be required for a mine permit, if the leases are issued (see Section 2.10, Management and Mitigation).

2.12 COMPARISON OF ALTERNATIVES

This section summarizes the impacts of the alternatives. Environmental consequences of each alternative are addressed in Chapter 3.0, Environmental Analysis. *Table 2-3, Summary of Impacts by Alternative for Each Issue*, compares alternatives to the issues that drove alternative development, as well as those issues identified as being important to assess the impacts of the alternatives. Issues are identified in Section 1.8, Issues and Concerns, in Chapter 1.0, Purpose and Need for Action.

Table 2-3
Summary of Impacts by Alternative for Each Issue

Issue/Concern	Alternative			
	A	B	C	D
AIR QUALITY				
Effects from Fugitive Dust	None-no mining from lease tracts or exploration	Low	Low	Low
Effects from Gaseous Emissions	None-no mining from lease tracts or exploration	Low	Low	Low

Table 2-3
Summary of Impacts by Alternative for Each Issue

Issue/Concern	Alternative			
	A	B	C	D
Visibility Effects on West Elk Wilderness Area	None-no mining from lease tracts or exploration	Low - Moderate	Low - Moderate	Low - Moderate
Visibility Effects on Black Canyon of the Gunnison	None-no mining from lease tracts or exploration	Negligible	Negligible	Negligible
AQUATIC RESOURCES/FISHERIES				
Direct Disturbance to Stream Channels	None-no mining from lease tracts or exploration	Moderate-High	Moderate-High	Low
Reduced Flow	None-no mining from lease tracts or exploration	Low-Moderate	Low-Moderate	Low
Stream Sedimentation	None-no mining from lease tracts or exploration	Low-Moderate	Low-Moderate	Low
Water Quality Degradation	None-no mining from lease tracts or exploration	Low	Low	Low
Impacts to Threatened and Endangered Aquatic Species	None-no mining from lease tracts or exploration	Negligible	Negligible	Negligible
CULTURAL RESOURCES				
Impact to Cultural and Historic Sites	None-no mining from lease tracts or exploration	Low	Low	Low
GEOLOGY/SUBSIDENCE				
Potential Effect to Curecanti-Rifle 230/345 kV Electric Transmission Line	None-no mining from lease tracts or exploration	None	None	None
Potential Effect to Terror Creek Reservoir	None-no mining from lease tracts or exploration	Low	Low	Low
Potential Effect to Terror Creek	None-no mining from lease tracts or exploration	Moderate	Moderate	Negligible
Potential Effect to Hubbard Creek	None-no mining from lease tracts or exploration	Moderate	Moderate	Negligible
Potential to Aggravate Landslides	None-no mining from lease tracts or exploration	Low	Low	Low
Land Use				
Acres Disturbed (total)	Not Applicable to lease tracts or exploration	33.5	33.5	33.5

Table 2-3
Summary of Impacts by Alternative for Each Issue

Issue/Concern	Alternative A	Alternative B	Alternative C	Alternative D
Land Disturbed by Ownership (%) ▸ BLM ▸ Forest Service ▸ Private	Not Applicable to lease tracts	26 59 15	27 62 11	27 62 11
Noise*				
Noise Effects From Surface Facilities	Low - Moderate	Low - Moderate	Low - Moderate	Low - Moderate
Noise Effects From Coal Trucks	Low - High	Low - High	Low - High	Low - High
Noise Effects From Coal Trains	Moderate - High	Moderate - High	Moderate - High	Moderate - High
* Noise effects vary based on distance from the noise source.				
Recreation				
Disruption to Recreational Opportunities in Undeveloped Areas	Not Applicable to lease tracts	Negligible	Negligible	Negligible
Changes in Recreational Access to Undeveloped Areas	Not Applicable to lease tracts	Negligible	Negligible	Negligible
Socioeconomics				
Projected Total Life of Mining ▸ Iron Point Tract ▸ Elk Creek Tract	1.5* 3*	5 5	8 6	7.5 6
* Remaining permitted life assumptions of Bowie No. 2 and Sanborn Creek mines under No-Action Alternative.				
Annual Employment During Mining ▸ Iron Point Tract ▸ Elk Creek Tract	157** 215**	168 215	168 215	168 215
** Current employment levels at Bowie No. 2 and Sanborn Creek mines.				
Projected Multi-Year Tax Revenues for Mining of Iron Point and Elk Creek Tracts (direct + indirect)	0	$88,500,000	$123,900,00	$119,475,000
Projected Federal Coal Royalties From Mining Iron Point and Elk Creek Tracts	0	$35,500,000	$46,900,000	$45,225,000
Surface and Groundwater				
Changes in Surface and Groundwater Chemistry	Not Applicable to lease tracts	Low	Low	Low
Potential Impact to Terror Creek Reservoir	None	Low	Low	Low
Potential to Alter Downstream Flow Rates	Not Applicable to lease tracts	Moderate	Moderate	Low

Table 2-3
Summary of Impacts by Alternative for Each Issue

Issue/Concern	Alternative			
	A	B	C	D
Transportation				
Average Number of Round Trips per Day for North Fork Branch Railroad (Cumulative)	4.4 @ 8.6 million tons per year	10 @ 19.2 million tons per year	10 @ 19.2 million tons per year	10 @ 19.2 million tons per year
Average Number of Round trips per Day for Coal Truck haulage Between Bowie No. 2 Mine and Bowie No. 1 Loadout	978 @ 5 million tons per year production	978 @ 5 million tons per year production	978 @ 5 million tons per year production	978 @ 5 million tons per year production
Potential for Accidents at Railroad Crossings	Low	Low	Low	Low
Potential for Accidents on State Highway 133 Due to Coal Truck Haulage	Moderate	Moderate	Moderate	Moderate
Potential for Accidents by Using Private Haul Road, Conveyor or by Moving Bowie No. 1 Loadout	Low	Low	Low	Low
Vegetation				
Number of Threatened and Endangered Plants Lost	None-no mining from lease tracts or exploration	0	0	0
Potential Impact of Noxious Weeds	None-no mining from lease tracts or exploration	Low	Low	Low
Potential Impact to Sensitive Plants	None-no mining from lease tracts or exploration	Low to Moderate	Low to Moderate	Negligible
Wetlands				
Potential to Impact Wetlands/Riparian Zones				
▸ Terror Creek	None-no mining from lease tracts or exploration	Low	Low	Negligible
▸ Hubbard Creek	None-no mining from lease tracts or exploration	Low	Low	Negligible
Wildlife (Terrestrial)				
Impacts to Threatened and Endangered Terrestrial Wildlife Species	None-no mining from lease tracts or exploration	Low	Low	Very Low
Impacts to Deer/Elk Habitat	None-no mining from lease tracts or exploration	Negligible - Low	Negligible - Low	Negligible - Low

Chapter 3

Environmental Analysis

3.0 ENVIRONMENTAL ANALYSIS

This chapter of the Environmental Impact Statement (EIS) describes both the existing conditions of and the environmental consequences to the area and resources, based on the alternatives described in Chapter 2.0, Alternatives Including the Proposed Action. For ease of presentation and comparison, the analysis discussions are separated into individual resource areas, such as air quality, geology, noise, wildlife, etc. Although the anticipated environmental effects of alternatives were analyzed for each resource discipline, impact analyses emphasize those disciplines that relate to the key issues and concerns identified in Chapter 1.0, Purpose and Need for Action. Some impacts are expressed in qualitative terms, other in quantitative terms.

Impact descriptions under each resource area are divided into the following categories:

- Effects Common to All Action Alternatives;
- Effects of the No-Action Alternative; and
- Effects Unique to Each Action Alternative.

Impacts are defined as follows:

- **Direct Impacts -** Those effects which occur at the same time and in the same general location as the activity causing the effects.

- **Indirect Impacts -** Those effects which occur at a different time or different location than the activity to which the effects are related.

- **Cumulative Impacts -** Those effects which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.

- **Irreversible Commitments -** Those commitments that cannot be reversed, except perhaps in the extreme long term.

- **Irretrievable Commitments -** Those commitments that are lost for a period of time.

The effect's analyses in this chapter are based on reasonably foreseeable development scenarios discussed in Section 2.2, Formulation of Alternatives, for the lease tracts and the exploration license area. For the lease tracts, potential effects consider impacts related to subsidence as presented in *Appendix K, Subsidence Evaluation.* The subsidence evaluation was completed assuming “best estimate” mining scenarios (reasonably foreseeable development).

Mitigation measures to be implemented for any exploration or mining activity are addressed in Chapter 2.0, Alternatives Including the Proposed Action. By design, each alternative has built-in mitigation in the form of standard and special stipulations that would be added to any lease or license. Effective mitigation avoids, minimizes, rectifies, reduces, or compensates for potential impacts. After mitigation is applied, any unavoidable adverse impacts to each resource area are addressed. Based on the impact analysis for the individual resource areas with this chapter, additional mitigation measures are listed which could further reduce environmental impacts should exploration and mining be conducted.

3.1 AIR QUALITY/CLIMATE

Issue: *Identify and minimize air quality impacts. Areas of concern include: the effects on air quality from fugitive dust and gaseous emissions, air quality impacts (visibility on the West Elk Wilderness Area), and cumulative air quality effects.*

3.1.1 Introduction

This section describes the following items related to air quality:

- Regional climate and existing air quality;
- Air quality regulations that apply to the mining operations and the railroad;
- Industrial operations conducted by Bowie and Oxbow that are permitted by the Colorado Air Pollution Control Division (APCD);
- Project-related emission rates from mining activities;
- Ambient air quality impacts adjacent to the existing mine sites;
- Health effects and odor impacts at areas near the mining operations and along the railroad tracks; and
- Air quality impacts to the nearby West Elk Wilderness Area.

3.1.2 Affected Environment and Air Quality Regulations

3.1.2.1 Regional Climate

Temperature and precipitation data for the Paonia area are listed in *Table 3.1-1, Temperature and Precipitation Data for Paonia, Colorado*. Precipitation amounts are generally believed to increase to the east. The mountain valleys on the western side of the Rockies are subject to wide ranges in precipitation and temperature conditions. Low precipitation amounts are normal during all seasons. Low summer precipitation, along with high temperatures and low humidity produce conditions favorable for wind erosion. Summertime rain is often associated with passing thunderstorms. Temperatures above 100°F are infrequent. Prolonged cold conditions are common in the mountain valleys and result when cold, dense air fills the valleys.

Wind directions at the three mines vary considerably and are likely governed by the direction of the serpentine river valley. Annual wind distributions measured at Somerset (for the West Elk Mine monitoring station) from March to August 1987 are presented as an annual wind rose in *Figure 8, Wind Rose for West Elk Mine*.

The West Elk wind station was located at a spot where the river valley trended in a WNW-ESE direction. Based on anecdotal evidence, it is likely that prevailing wind directions near Bowie follow the river valley, which trends in an SE-NW direction. To simulate a wind rose at Bowie the measured winds from the West Elk station were rotated 120 degrees so the prevailing wind directions follow the river valley between Paonia and Bowie. The resulting wind rose at the Bowie No. 2 Mine is shown in *Figure 8-b, Adjusted Wind Rose for Bowie*.

Table 3.1-1
Temperature and Precipitation Data for Paonia, Colorado

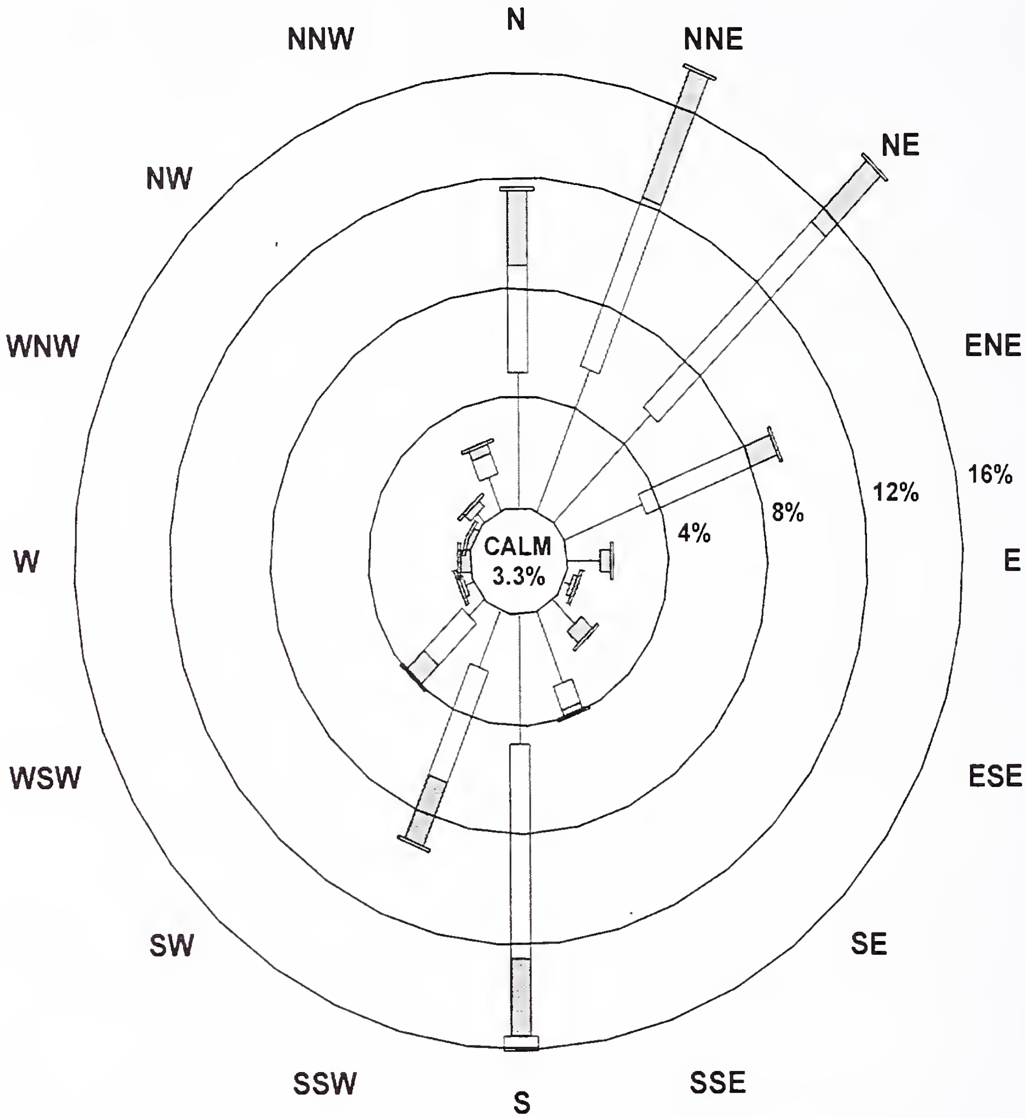
Month	Precipitation (in)	Temperature (°F)
January	1.08	24.9
February	1.03	31.6
March	1.38	39.3
April	1.28	47.4
May	1.34	56.8
June	0.84	66.1
July	1.14	72.6
August	1.21	70.5
September	1.48	62.0
October	1.61	51.3
November	1.36	38.7
December	1.42	28.2
Annual	15.17	49.1
Data Source:	National Climatic Data Center Period of Record: 1976 through 1998	

Wind roses depict the joint frequency of occurrence, in percentage, of wind speed and wind direction categories for a particular location and time period. The radials of the wind rose indicate the direction from which the wind is blowing. The length of the radials indicates the frequency of occurrence for that direction, and the width of the radials indicates the wind speed class.

The wind roses display a wind pattern that is common for a narrow river valley. Strong persistent winds blow along the valley, and weak infrequent winds blow across the valley. The prevailing winds blew up-valley or down-valley with a high wind speed (3.8 meters/second average). Cross-valley winds were infrequent (less than 5 percent frequency of occurrence) with a low speed (2.5 meters per second). The average wind speed for all directions was 3.6 meters per second.

3.1.2.2 Ambient Air Quality Standards

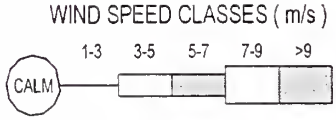
The Federal Clean Air Act required the U.S. Environmental Protection Agency (EPA) to set ambient air quality standards (AAQS) to protect the public health and welfare. Standards to protect public health (primary standards) were developed to protect the most sensitive individuals and allow for a margin of safety. When a health-based primary standard does not protect public property or resources (for example, ensuring that dust concentrations are low enough to prevent damage to crops or soiling of buildings), EPA specified a secondary standard more restrictive than the primary standard. In some cases Colorado adopted ambient standards that are more restrictive than EPA's limits.



EXPLANATION

AVERAGE WIND SPEED = 3.52 m/s

WIND SPEED CLASSES (m/s)



ROTATED WIND ROSE FOR
RIVER VALLEY BETWEEN
PAONIA AND BOWIE

NOTE:
(1). From West Elk Mine in Gunnison County, Colorado
(2). Data Taken March 1987 through August 1987
(3). SOURCE: Air Sciences Inc. of Lakewood, Colorado

FIGURE 8-b
ADJUSTED WIND ROSE FOR BOWIE

Applicable AAQS are listed in *Table 3.1-2, Ambient Air Quality Standards*. Air quality standards have been established for carbon monoxide (CO), lead (Pb), particulate matter with aerodynamic diameters less than 10 micrometers (PM_{10}), nitrogen dioxide (NO_2), ozone (O_3), and sulfur dioxide (SO_2). The table lists standards for PM2.5 and ozone that have been proposed by EPA but not yet approved. These proposed standards will apply to the mines if they are approved.

Table 3.1-2
Ambient Air Quality Standards

Pollutant	EPA		Colorado
	Primary	Secondary	
Proposed Fine Particulate Matter (PM2.5) (μg/m^3) (proposed but not yet enacted)			
Annual arithmetic average	15	15	15
24-hour average	65	65	65
Fine Particulate Matter (PM10) (μg/m^3)			
Annual arithmetic average[1]	50	50	50
24-hour average	150	150	150
Carbon Monoxide (ppm)			
8-hour average	9	9	10
1-hour average	35	35	40
Ozone (ppm)			
8-hour average (proposed)	0.08	0.08	0.08
1-hour average	0.12	0.12	0.12
Sulfur Dioxide (ppm)			
Annual average	0.03	0.02	0.006
24-hour average	0.14		0.038
3-hour average		0.05	0.267
Lead (μg/m^3)			
Calendar quarter average	1.5		1.5
Nitrogen Dioxide (ppm)			
Annual Average	0.053	0.053	0.05

Source: 40 CFR Part 50
Notes: ppm = parts per million
(μg/m^3) = micrograms per cubic meter

Primary and secondary standards have been established for particulate matter that can be respired by humans. A number of published studies suggest that premature mortality, hospital admissions, and respiratory illnesses occur at concentrations below the PM_{10} standards. In 1997, EPA revised the particulate matter standards by proposing new standards for particles smaller than 2.5 micrometers (PM2.5). The PM2.5 standards are currently under development and do not yet apply to any facilities.

3.1.2.3 Regional Air Quality

The air quality in Delta and Gunnison counties is generally good and achieves all state and national AAQS based on information from the nearest air pollution monitoring stations. The second highest 24-hour and annual average PM_{10} concentrations measured at Delta, Colorado for 1993 through 1998 are presented in *Table 3.1-3, Ambient PM10 Concentrations at Delta, Paonia and Hotchkiss, Colorado.* Windblown dust and wood stoves are believed to be the most prevalent air pollutant emission sources in the region, so the state operates monitors for only PM10 in Delta and Gunnison counties.

Table 3.1-3
Ambient PM10 Concentrations (μg/m3) at Delta, Paonia and Hotchkiss, Colorado

Year	Delta		Paonia		Hotchkiss	
	Second Highest 24-hour	Annual Average	Second Highest 24-hour	Annual Average	Second Highest 24-hour	Annual Average
1993	70	29.5	No Data	No Data	No Data	No Data
1994	69	31.5	No Data	No Data	No Data	No Data
1995	67	24.4	No Data	No Data	No Data	No Data
1996	No Data	25.6	No Data	No Data	No Data	No Data
1997	50	23.1	24	16	53	26
1998	40	22.8	35	17	66	27

Measured PM10 concentrations for Paonia and Hotchkiss have been relatively low. However, short-term excursions have occurred. On March 31, 1999 a large dust storm engulfed western Colorado. The measured 24-hour PM10 concentrations on that day were 467 $\mu g/m^3$ at Paonia and 470 $\mu g/m^3$ at Hotchkiss. Similar concentrations were measured at most other PM10 stations throughout the region.

The Paonia-Somerset area of the North Fork of the Gunnison River has been designated as a Prevention of Significant Deterioration (PSD) Class II area. PSD Class II areas are those in which development may occur. The release of limited concentrations of certain pollutants over Class II PSD increments is permitted as long as AAQS is maintained and emissions are within the PSD Class II increment. The nearest PSD Class I area (an area where little air quality deterioration is allowed) is the West Elk Wilderness, located approximately 10 miles south-southeast of the Somerset area. Another PSD Class I area in the region is the Black Canyon of the Gunnison National Park, located approximately 26 miles to the southwest of the Somerset area.

3.1.2.4 Air Permitting Requirements for Industrial Sources

All industrial sources in Colorado must receive an Air Pollution Emission Notice (APEN) permit from the Colorado APCD before they begin to develop any new processes or expand any existing processes. The APEN permit specifies the following requirements:

- Type of equipment that is permitted to be installed;
- Type of pollution control equipment that is required;
- The types of emission monitoring and testing that are required;
- Allowable production rate; and
- Allowable emission rates.

The Bowie and Oxbow mining operations near Paonia have already received their APEN permits to expand their coal production rates to the values specified in Chapter 2.0, Alternatives Including the Proposed Actions.

3.1.2.5 Prevention of Significant Deterioration Permitting (Not Required for Bowie Resources or Oxbow Mining)

Colorado APCD imposes stringent requirements for large industrial sources under the PSD program. PSD permitting applies only to industrial facilities that emit more than 250 tons per year of PM_{10}, NO_x, or SO_2 from stationary, non-fugitive dust sources.

None of the coal mining facilities in the North Fork of the Gunnison River area are subject to PSD permitting because none generate sufficient non-fugitive emissions to trigger PSD permits. The mines emit only about 10 to 50 tons per year of PM_{10} from non-fugitive sources, well below the 250 ton/year PSD threshold. Because the non-fugitive emissions are so low, the increases in fugitive dust emissions caused by the mine expansions are not subject to PSD permitting. This means that the allowable ambient concentrations at the facility boundaries are the ambient standards listed in *Table 3.1-2, Ambient Air Quality Standards*, rather than the more restrictive PSD Class II increments (30 $\mu g/m^3$ for the 24-hour average and 17 $\mu g/m^3$ for the annual average).

3.1.2.6 Federal Emission Standards for Locomotives and Non-Road Diesel Engines

EPA has enacted regulations that will require diesel locomotives and large diesel mine equipment to reduce their emissions. The regulations require retrofitting of locomotives, though retrofits are not required immediately. Instead, the locomotives must be retrofitted when they are next refurbished after their normal operating cycle (about 750,000 hours of operation). EPA estimates that, on a nationwide average, the NO_x emissions from locomotives in the year 2010 will decrease by about 40 percent compared to their current levels. For this EIS, EPA's published emission factors for the year 1999 were used to estimate the year 1998 baseline emissions from locomotives, and EPA's new NO_x emission factors were used to estimate emissions for the No-Action and Proposed Action (EPA, 1997).

EPA has also enacted new regulations on emissions from diesel-powered construction equipment, but these new regulations will have little effect on emissions from underground coal mines. Underground diesel equipment is excluded from EPA's new rule. The new regulations for large above ground diesel equipment will apply only to equipment manufactured after 2006. For this EIS, it is assumed that all of the aboveground mining equipment emits at rates specified by manufacturer's emission factors for the year 1999.

3.1.3 Environmental Consequences

The Bowie and Oxbow mines have received APEN air permits for production rates of 5 and 4.8 million tons per year, respectfully. The operations included in the APEN permits for the two mines are itemized in the following tables.

- *Table 3.1-4, Permitted Mining Processes at Bowie Resources.* The APEN allows production at 5 million tons/year. Bowie's permit accounts for installation of the proposed new truck loading facility in the valley floor. The permit allows continued use of truck hauling from the upper surface facility.

- *Table 3.1-5, Permitting Mining Processes at Oxbow Mining*. The Oxbow Mine is permitted for 4.8 million tons/year.

Emission calculations and impact assessments are provided in *Appendix M, Air Quality Impact Assessment*.

The air quality impacts are summarized as follows.

- Due to anticipated increased coal production from the coal mines in the North Fork of the Gunnison River area, emissions from regional mining operations and coal trains are expected to increase for all alternatives.

- The EIS alternatives would increase local emissions of particulate matter and tailpipe exhaust by about 7 to 8 percent compared to 1998 conditions.

- All coal mines are regulated by the Colorado APCD. Particulate emissions from the mines are minimized by use of conventional air pollution control equipment.

- Based on air dispersion modeling, it is concluded that dust emissions from the mines do not cause any ambient air quality impacts.

- Based on modeling, it is concluded that the incremental increases in particulate emissions and gaseous emissions resulting from coal production from the Bowie and Oxbow operations would not cause any consequential acid deposition or visibility impacts at the nearby West Elk Wilderness Area.

3.1.3.1 Emission Estimates for Year 1998 Baseline

For this EIS, the air quality impacts for the No-Action and Action Alternatives are compared to the year 1998, which was the start of the EIS process for the coal tract leases.

In the year 1998, the three mines operated at the following production rates.

Bowie No. 2 Mine	1.2 million tons/year
Oxbow Mining	1.5 million tons/year
Mountain Coal, West Elk Mine	5.9 million tons/year
Combined Production	8.6 million tons/year

Table 3.1-4 Permitted Mining Processes at Bowie Resources				
Permit No.	**Description of Processing Unit**	**Control Device**	**Permitted Annual Coal Throughput (tons/yr)**	**Permitted PM10 Emissions (tons/yr)**
Bowie No. 2 Mine				
96DL103-1	Allis Mineral Systems Screen (1500 lph) S/N: 90KA09493	Spray Bars	5,000,000	5.25
96DL103-4	Coal loadout silo facility	Fully Enclosed	5,000,000	0.86
96DL103-6	Jeffrey model 611 flex tooth crusher (800 lph)	Spray Bars	5,500,000	1.80
96DL103-7F	Above-ground fugitive emission producing activities			
	Conveyors		5,000,000	4.69
	Coal and GOB hauling		5,000,000	111.02
	Finished Product Stockpiles (coal)		350,000	
	Finished Product Stockpiles (stoker coal)		5,000	
	raw Material Stockpiles (coal)		60,000	
	Raw Material Stockpiles (GOB)		15,000	
98DL0726	Ventilation shaft w/blower rated at 850,000 cfm		5,000,000	13.95
Total Permitted PM10 Emissions				**138**
Bowie No. 1 Loadout Truck Dump and Rail Car Loading				
11DL252-6	Truck dump station	Mikropul Model No. 336 KTR-10 baghouse	5,000,000	0.035
11DL252-7	Silos 1-3	Mikropul Model No. 64STR-10-20 baghouse	5,000,000	0.11
11DL252-10	Rail car loading facility	Mikropul Model No. 144 STR-10-20 baghouse	5,000,000	3.67
Total Permitted PM10 Emissions				**3.8**

Emissions of fugitive dust and tailpipe emissions for the year 1998 for each mine in the study area are itemized in *Table 3.1-6, Summary PM Emissions From Regional Mines,* and *Table 3.1-7, Summary of Emissions for 1998 Baseline, and Proposed Action*

3.1.3.2 Effects of Alternative A (No-Action)

Since the issuance of the Draft EIS, Bowie has received approval from the Colorado DMG and the Colorado APCD to operate at an annual production rate of 5 million tons of coal. Similarly, Oxbow is permitted by these agencies for an annual production rate of 4.8 million tons of coal. Therefore, emission rates for the No-Action Alternative would be the same as for the Action Alternatives. See Section 3.1.3.3, Effects Common to All Alternatives.

Table 3.1-5 Permitted Mining Processes at Oxbow Mining		
Description of Processing Unit	**Permitted Annual Coal Throughput**	**PM_{10} Emissions (tons/yr)**
Mining Related Process Sources		
Sanborn Creek Mine	4,8000,000 tons	0.438
Elk Creek Mine	4,800,000 tons	0.146
Stacking Tubes	4,800,000 tons	0.111
Loading Related Process Sources		
Reclaim Tunnel	4,800,000 tons	0.075
Screening Plant	4,800,000 tons	1.12
Dump Station	4,800,000 tons	0.157
Crusher	4,800,000 tons	0.29
Crusher Bypass to Train Loadout	4,800,000 tons	0.186
Miscellaneous	9,125 tons	0.0125
Fugitive Sources		
Stacking Tube Stockpile	4,800,000	24.2
Temporary Stockpiles	1.72 acres	10.4
Hauling	11,095 VMT*	2.46
West Valley Fill	1.98 acres	1.941
Existing Rock Fill Area	1.21 acres	0.17
Construction Related		13.63
Grand total permitted PM_{10} Emissions		**55.34**
* VMT = Vehicle Miles Traveled		

3.1.3.3 Effects Common to All Alternatives

Impacts to air quality stem primarily from the operation of surface facilities and equipment including trucks and locomotives. Since the same facilities and equipment would be operated for all alternatives, no distinction between alternatives A through D is made for this discipline.

It is assumed for air quality purposes that the three local mines in the North Fork Valley would operate at the following production rates for all alternatives (including the No-Action and the Action Alternatives).

Bowie No. 2 Mine	5 million tons/year
Oxbow Mine	4.8 million tons/year
Mountain Coal, West Elk Mine	8.2 million tons/year
Combined Production	18.0 million tons per year

Table 3.1-6 Summary of PM Emissions From Regional Mines			
Facility	**Annual Production (million tons/ year)**	**PM_{10} Emission Factor (lbs/ton of coal)**	**Annual PM_{10} Emissions (tons)**
Year 1998 Emissions			
Bowie No. 2 Mine	1.2	0.059	35.4
Bowie No. 1 Loadout	1.2	0.00152	0.9
Oxbow Mining	1.5	0.0259	19.4
Mountain Coal (West Elk)	5.9	0.0257	75.8
Regional Total			**132**
Alternatives			
Bowie No. 2 Mine	5	0.059	147.5
Bowie No. 1 Loadout	5	0.00152	3.8
Oxbow Mining	4.8	0.0259	62.2
Mountain Coal (West Elk)	8.2	0.0257	105.4
Regional Total			**319**

All alternatives would cause emission increases compared to the year 1998. The air quality impacts caused by these emission increases are expected to be as follows:

Increased Particulate Emissions - Fugitive dust from Above-ground coal handling would increase compared to the year 1998, causing an increase in PM_{10} emissions from the mines, haul trucks, and trains (see *Table 3.1-7, Summary of Emissions for 1998, and Proposed Action*).

Increased Tailpipe Emissions From Mining Equipment - Use of underground and Above-ground diesel equipment would increase compared to the baseline year resulting in increased tailpipe emissions. The increased emissions of NO_x and SO_2 would not have any significant impact on acid deposition or visibility at West Elk Wilderness.

Decrease in Railroad Emissions - As shown in *Table 3.1-7, Summary of Emissions for 1998, and Proposed Action*, EPA's new regulation on locomotive emissions would mean that increases in coal production do not cause any substantial increases in locomotive emissions. The NO_x emissions from locomotives would actually decrease for the alternatives as compared to the 1998 baseline year, when locomotive engines are retrofitted to meet EPA's new regulations.

Ambient Air Quality Impacts Near Bowie No. 2 Mine and Oxbow Mines - These two mines, like other Colorado coal mines, are regulated by Colorado APCD and are required to use well-operated and well-maintained emission control devices to minimize particulate emissions. Each mine is further required to control fugitive dust by watering during dry weather. The frequency of watering depends on weather conditions, but is expected to be at least several times a day. Further, the size of coal storage piles would be minimized to the extent possible given production and coal sales and shipment.

Table 3.1-7
Summary of Emissions for 1998 and Proposed Action

Coal Production Rates (million tons per year)

Source	Year 1998	All Alt.
Bowie	1.2	5
Oxbow	1.5	4.8
West Elk	5.9	832
Total	8.6	18

Emission Increases Input to Models (tons/year)

	Grand Total PM_{10}		Grand Total NO_x		Grand Total SO_2		PM_{10} Increase	NO_x Increase	SO_2 Increase
Source	**Year 1998**	**All Alt.**	**Year 1998**	**All Alt.**	**Year 1998**	**All Alt.**	**All Alt. Minus Baseline**	**All Alt. Minus 1998 Levels**	**All Alt. Minus 1998 Levels**
West Elk	84	115	376	442	39	46	31	66	7.2
Oxbow	24	68	190	253	21	26	44	63	5.6
Bowie No. 2	40	154	178	233	19	25	114	55	6.0
Haul Trucks	19	77	4	18	2	9	59	14	6.8
Bowie Rail Facility	1	3.8	6	21	0.3	1.1	2.9	15	0.8
Railroad 4	1.2	2.2	40	35	2.2	3.8	1.0	-5	1.6
Railroad 3	1.2	2.2	40	35	2.2	3.8	1.0	-5	1.6
Railroad 2	1.2	2.2	40	35	2.2	3.8	1.0	-5	1.6
Railroad 1	1.2	2.2	40	35	2.2	3.8	1.0	-5	1.6
Project-Related Emissions	**173**	**427**	**905**	**1,107**	**90**	**122**	**255**	**192**	**33**

Colorado APCD has conducted modeling of the maximum PM_{10} concentrations at the facility boundaries of each of the mines. Their modeling was completed as part of the air permitting for the Bowie and Oxbow operations. The Colorado APCD used the 6 months of wind data that were taken at the West Elk Mine as input to the ISCST computer dispersion model (see *Figure 8, Wind Rose for West Elk Mine*). As set forth in *Table 3.1-8, Modeled PM10 Impacts at Facility Boundaries*, the Colorado DPHE concluded that, based on this limited amount of meteorological data (commonly 1 year or more wind data is needed to run dispersion models), the maximum emissions from the mines would not cause PM_{10} concentrations at the facility boundaries to exceed the ambient standards.

The ISCST dispersion model predicts a conservatively high impact, so, based on the available wind data, it is concluded that the PM_{10} impacts surrounding the Bowie and Oxbow operations would be below the AAQS if the two mining firms operate their air pollution control equipment in accordance with their APEN air quality permits. The PM_{10} AAQS limits are "secondary

Table 3.1-8 Modeled PM_{10} Impacts at Facility Boundaries				
Averaging Period	PM_{10} Impact Caused by Mine Emissions ($\mu g/m^3$)	Background PM_{10} Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	Ambient Air Quality Standard ($\mu g/m^3$)
Oxbow Mining at 4.8 million tons per year				
24-hour average	112	16	128	150
Annual Average	22	16	38	50
Bowie No. 2 Mine at 5 million tons per year				
24-hour average	126	21	147	150
Annual average	27	15	42	50

standards" that were specified by EPA to prevent "public welfare" impacts such as soiling of buildings and crop damage, as well as protecting public health. The modeled maximum PM_{10} concentrations at the facility boundaries were less than the AAQS.

All alternatives would involve additional daily railroad traffic to and from the mines in the North Fork Valley as compared to the 1998 levels of railroad traffic. The windblown coal dust from the coal cars is expected to be much less than the particulates emitted from the diesel engine exhaust. All diesel engines are recognized to emit trace amounts of organic compounds (for example, aldehydes) that can cause short-term odor impacts. There could be minor, short-term odor impacts along the railroad line between Somerset and Delta.

Explosion Hazard From Methane Emissions **-** Methane gas is liberated from the underground coal formations during mining. Federal health and safety laws require underground coal mines to operate underground ventilation systems to prevent buildup of potentially explosive methane at underground locations. The collected methane gas is emitted to the atmosphere via ventilation fans which are located at the surface of each mine. The methane that is collected underground is diluted by the ventilation airflow to concentrations that are far below methane's flammability limits.

Impacts to Visibility and Acid Deposition at West Elk Wilderness and Black Canyon National Park **-** The action alternatives would increase emissions of particulate matter, NO_x and SO_2 from sources along the floor of the North Fork of the Gunnison River Valley as compared to the 1998 levels. Such emissions could reach the West Elk Wilderness or Black Canyon National Park (*Figure 9, Emission Sources and Wilderness Area Receptors for Visibility and Acid Deposition Modeling*). The emitted NO_x and SO_2 can react inside the plume to convert to nitric acid and sulfuric acid, which can cause increases in acid deposition at the alpine regions of the wilderness area. The nitric acid and sulfuric acid can also react with ammonia in the atmosphere to form "secondary particles" that can form a regional haze that impacts visibility at locations far from the emission source. In addition, the emissions can cause a distinct plume (called "plume blight") during the first few miles downwind before the plume breaks up as it travels through rugged terrain.

Visibility and acid deposition impacts were evaluated at the following wilderness area receptors.

- Acid deposition impacts were evaluated at South Golden Lake at the northern part of West Elk Wilderness (22 miles from the historic town of Bowie).

- Regional haze was evaluated at the northwest boundary of West Elk Wilderness (11 miles from the historic town of Bowie) and the northeast corner of Black Canyon National Park.

- Plume blight from the Bowie No. 2 Mine was evaluated for a viewer on top of Mt. Gunnison (at the northwest part of West Elk Wilderness) and a viewer at the northeast corner of Black Canyon National Park.

The results of the impact assessment are summarized in *Table 3.1-9, Visibility and Acid Deposition Impacts at West Elk Wilderness and Black Canyon National Park.*

Modeling of the visibility and acid deposition impacts is further described in *Appendix M, Air Quality Impact Assessment.*

3.1.4 Cumulative Impacts

Emissions associated with Mountain Coal's West Elk Mine would contribute to increases in PM_{10} and NO_x emissions; however major contributors to such emissions would be from the existing urban, industrial and agricultural activities of the region. Cumulative air quality impacts from the West Elk Mine are considered in the calculations made in Section 3.1.3.3, Effects Common to All Alternatives, and in *Appendix M, Air Quality Impact Assessment.*

The effect of increasing production to 6 million tons of coal per year on the Elk Creek Coal Lease Tract would slightly increase air impacts.

Bowie No. 2 Emissions Based on Continued Use of Haul Trucks - The PM_{10} emission rates from the Bowie No. 2 Mine assumed that Bowie would continue to use haul trucks between the upper surface facility and the Bowie No. 1 Loadout near Paonia. Fugitive emissions from the haul trucks are the largest PM_{10} source at the mine. Bowie has received its air permit to construct a coal conveyor from its portal area to a new truck loadout adjacent to old State Highway 133; this conveyor will replace coal truck traffic on the steep road from old State Highway 133 to the portal. If Bowie proceeds with the construction of a new train coal loadout for the Bowie No. 2 Mine, then the PM_{10} emission rates for the "Proposed Action" would further decrease.

Meteorological Data - All air quality modeling analyses rely on meteorological data. For the modeling analyses conducted here, only a limited (6 months) set of site specific (influenced by up and down-valley winds) meteorological data existed at the time of the analysis. This data was used because it was the best available at the time, and has been used by the Colorado Air Pollution Control Division in the past. The Colorado Air Pollution Control Division has expressed concerns that the deficiencies in the available meteorological data would increase modeling uncertainties. Therefore, a proposed mitigation measure to collect additional meteorological data has been discussed in Section 3.1.5, Potential Air Quality Mitigation and Monitoring.

Table 3.1-9
Visibility and Acid Deposition Impacts at West Elk Wilderness and Black Canyon National Park(1)

Parameter	Modeled Value	Threshold for Significant Impact
Assumed Background Conditions		
Visual range at West Elk Wilderness	290 km	--
Visual range at Black Canyon	221 km	--
Increase in 24-hour Average B-ext light Extinction Coefficient		
SCREEN3 Impact at northwest corner of West Elk Wilderness (Proposed Action Minus Baseline)	8.7% B-ext increase	5% increase
SCREEN3 impact at northwest corner of West Elk Wilderness (Proposed Action Minus No-Action)	4.7% B-ext increase	5% increase
Highest day impact at northwest corner of West Elk Wilderness using ISC3 model	19.8% B-ext increase	5% increase
95th percentile worst impact at northwest corner of West Elk Wilderness using ISC3 model	4.3% B-ext increase	5% increase
SCREEN3 impact at northeast corner of Black Canyon	2.4% B-ext increase	5% increase
Acid Deposition at South Golden Lake at West Elk Wilderness		
Annual NO_x and SO_2 increases (Proposed Action Minus Baseline)	NO_x = 0.0002 μg/m3 SO_2 = 0.00008 μg/mc	--
Decrease in Acid Neutralization Capacity	1.6%	10%
PLUVUE Plume Blight Impact Downwind of Bowie No. 2 Mine		
Mt. Gunnison observer (worst case): looking upwind toward mine at sunset with sun behind the mine	E(L*a*b) = 4.9	2.0
Black Canyon observer (worst case): looking upwind toward mine at sunset	E(L*a*b) = 1.7	2.0
Other PLUVUE impacts for Mt. Gunnison and Black Canyon observers and viewing angles	E(L*a*b) ranges from 0.09 to 1.1	2.0

(1) Air quality modeling is based on a number of input parameters. For a discussion on uncertainty in air quality modeling, see Section 4.0, Uncertainty in modeling Methods and Assumptions, in Appendix M, Air Quality Impact Assessment.

3.1.5 Potential Air Quality Mitigation and Monitoring

The mitigation and monitoring measures for air quality are set forth in *Table 3.1-10, Potential Mitigation and Monitoring Measures for Air Quality.*

Table 3.1-10
Potential Mitigation and Monitoring Measures for Air Quality

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
AQ-1[3]	Reduction of fugitive dust emissions and visibility impacts to West Elk Wilderness Area and Black Canyon National Park.	Construct new train loadout at Bowie No. 2 Mine.	1	Mining Company
AQ-2	Provide additional air quality data for any future air quality permitting in the North Fork valley.	Install new PM_{10} monitoring stations and meteorological stations near Bowie and Oxbow mines.	2	Mining Company; CDPHE

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

AQ-1 - Construct New Train Loadout at Bowie No. 2 Mine. Bowie is considering the construction of a new train loadout at the Bowie No. 2 Mine. If Bowie proceeds with the construction of such a facility, the use of the new facility would be effective in reducing PM_{10} emission rates. Fugitive dust caused by haul truck traffic on State Highway 133 between the Bowie No. 2 Mine and the Bowie No. 1 Loadout accounts for about 100 tons per year of PM_{10} emissions. The coal trucks emit over 10 tons per year of NO_x. Replacement of coal truck haulage with coal trains would also result in a net reduction of the emissions that can create visibility impacts at the West Elk Wilderness Area.

AQ-2 - Install New PM_{10} and Meteorological Stations. The PM_{10} monitoring stations could be used to track compliance with the PM_{10} ambient air quality standards. The data from new PM_{10} and meteorological stations would be effective to improve accuracy of future air quality permitting efforts in the North Fork Valley.

3.2 TOPOGRAPHY/PHYSIOGRAPHY

Issue: *Identify the potential for subsidence from underground mining activities.*

3.2.1 Introduction

The analysis area encompasses the lands within and immediately surrounding the exploration license area and the coal lease tracts. Topography of the general area ranges from steep to relatively flat. Elevations range from slightly over 5,600 feet in the North Fork of the Gunnison River Valley near the town of Paonia to elevations over 10,000 feet in the mountains surrounding the exploration license and lease tract areas.

3.2.2 Affected Environment

The elevations in the Iron Point Exploration License area range from about 6,400 feet in the Hubbard Creek drainage and 7,500 feet in the Terror Creek drainage to over 8,400 feet in an area west of Terror Creek Reservoir. The exploration license area is drained by both Terror Creek and Hubbard Creek. These drainages flow in a general north-south orientation and empty into the North Fork of the Gunnison River Valley.

The elevations in the Iron Point Coal Lease Tract range from approximately 6,400 feet in the Hubbard Creek drainage and 6,800 feet in the Terror Creek drainage to over 8,200 feet on the upper reaches of the lease tract. The Iron Point Coal Lease Tract is drained by Terror Creek and Hubbard Creek. These drainages flow in a general north-south orientation and empty into the North Fork of the Gunnison River Valley.

The elevations in the Elk Creek Coal Lease Tract range from about 6,400 feet in the Hubbard Creek drainage and 6,700 feet in the Bear Creek drainage to over 8,500 feet in the upper reaches of the tract. The Elk Creek Coal Lease Tract is drained by Hubbard Creek, Bear Creek, and Elk Creek. These drainages flow in a general north-south orientation and empty into the North Fork of the Gunnison River.

The topography of the area has also been greatly influenced by a wide range of mass-movement landforms and processes within the North Fork of the Gunnison River Valley, including localized natural landslides and rock falls in the Hubbard Creek drainage. Landsliding in this region is usually preceded, accompanied, and followed by perceptible creep along the surface of the sliding or within the slide mass. Landslides, rock falls, and other areas of general geologic/topographic instability are shown on *Figure 11, Geologic Hazards Map.*

3.2.3 Environmental Consequences

The actual leasing of the Iron Point and Elk Creek Coal Lease Reacts would impose no topographic change on the tracts. Similarly, the exploration activities as proposed for the Iron Point Exploration License area would have no noticeable topographic impact.

If the tracts are leased subsequent underground longwall mining would cause subsidence as discussed in *Appendix F, Overview of Underground Coal Mining*, and *Appendix K, Subsidence Evaluation.* Subsidence would be most notable on ridges and steeper slopes, particularly cliffs, where cracks might open on the order of a few inches to possibly 1-foot wide and 25 to 50 feet deep. Fewer cracks would occur in the valleys than on ridges, because the valleys are more stable and the alluvial material found in the valleys tends to be more yieldable than some of the brittle bedrock found on the ridges. Subsidence from longwall mining could aggravate the movement of existing landslides and rock falls.

3.2.3.1 Effects of Alternative A (No-Action)

If the No-Action Alternative is selected, there would be no exploration activities in the Iron Point Exploration License area, and no mining activities would occur in either the Iron Point or the Elk Creek Coal Lease Reacts. Thus, there would be no topographic changes as a result of such activities. Natural landsliding and rock falls would continue, particularly in the Hubbard Creek drainage given its existing, natural geologic instability.

3.2.3.2 Effects Common to All Action Alternatives

Direct Effects - Subsidence amounts and processes regarding longwall mining are discussed in a general manner in *Appendix F, Overview of Underground Coal Mining*, and in *Appendix K, Subsidence Evaluation.* Subsidence does occur in areas above longwall mining. The amount of subsidence above longwall mining depends on many factors including mine plans, coal thickness, geologic strata, and overburden depth. As a general rule, the greater the overburden thickness, the less the surface subsidence. For example, assuming a coal extraction thickness of 12 feet for the D seam in the Elk Creek Coal Lease Tract, surface subsidence would be expected to be 7 to 8 feet for those areas with 500 feet of overburden. At overburden depths of 2,000 to 2,500 feet, surface subsidence would be projected between 1

and 3 feet. The subsidence over the gate roads (entries on either side of a longwall panel) is typically 1 to 2 feet less than the panel itself.

Topographic changes caused by subsidence with longwall mining are often unnoticeable to the untrained eye. As longwall mining proceeds under a particular area, there would be some cracking on the surface. As mining proceeds away from the area, this surface cracking tends to disappear, although the elevation of the area would be lower. In certain areas, such as the alluvial material in drainages, the alluvium would stretch but may or may not rupture when subsidence occurs.

Subsidence at any given point on the surface begins when the longwall face is beneath that point and is generally 90 percent complete when the longwall face has passed at 1.2 to 1.4 times the overburden depth beyond the point of mining. For example, at 500 foot depth of overburden, the subsidence beneath longwall mining would be 90 percent complete within about a month when the longwall face is 600 to 700 feet beyond that point on the surface. Other than lowering the land surface, the long-term effects of subsidence on surface topography would be minimal, and even unnoticeable to most casual observers. Some residual cracks may remain in the more brittle bedrock material on ridges or cliffs. Overall, the topography above subsided longwall mining workings would be similar to the pre-mining topography, albeit lower in elevation.

Subsidence from underground mining could aggravate, and perhaps even accelerate, the existing landslides and rock falls in the area, particularly those geologic hazards that occur in an area where the overburden depth is less than 500 feet. Other natural factors may cause an acceleration of impacts, these factors being separate from subsidence. For example, in an extremely wet spring, the moisture from snowmelt and spring rains could cause these natural landslides and rock falls to move and shift. This seems to have been the case in the mid 1980s, during a period of intense precipitation and moisture. It is difficult to assess whether the naturally occurring landslide and other unstable areas have been aggravated by subsidence.

Indirect Effects **-** There are no anticipated indirect long-term topographic impacts expected for surface facility disturbances supporting underground mining activities. These areas would be regraded and recontoured following mining closure and removal of structures in such a manner that the area would blend into the surrounding undisturbed terrain. See Section 2.7, Reclamation Measures.

3.2.3.3 Effects of Alternative B

Only minor direct surface disturbances would be associated with exploration (roads, drill sites) and potential mining of the two coal lease tracts (roads, ventilation raises, and degasification borehole pads). Such direct surface disturbance activities would not affect the topography of the area, and any surface disturbing activities would be reclaimed as set forth in Section 2.7, Reclamation Measures.

As explained in both *Appendix F, Overview of Underground Coal Mining*, and *Appendix K, Subsidence Evaluation*, there is a potential for surface subsidence as a result of longwall mining. The amount of subsidence would depend on overburden depth, but it would be relatively uniform across the topography and would not leave irregularly shaped depressions on the surface. Rather, the subsidence would be relatively uniform (i.e., the change in elevation due to subsidence would be essentially the same across each tract). On the fringes of the subsidence, some tension cracks may be visible, but they may heal with time. Some cracks, especially in bedrock never heal.

3.2.3.4 Effects of Alternative C

The impacts of Alternative C would be similar to those described Section 3.2.2.3, Effects Common to All Alternatives, and Section 3.2.2.4, Effects of Alternative B (Proposed Action). The exception with Alternative C would be that the amount of subsidence anticipated with multiple-seam mining would be greater than that of single seam longwall mining. An estimated maximum average subsidence for extraction of both the D and B coal seams would be 13 feet. See *Appendix K, Subsidence Evaluation*, for further information.

3.2.3.5 Effects of Alternative D

The impacts of Alternative D would be similar to those of Alternative C, except extra precautions (barner pillars, buffer zones, etc.) would be taken to prevent any subsidence in the Terror Creek and Hubbard Creek drainages, and beneath the Curecanti-Rifle 230/345 kV electric transmission line which is located in the Terror Creek drainage.

3.2.4 Cumulative Impacts

As discussed in Section 3.3.2.2., Geologic Hazards, the North Fork Valley region east of the town of Paonia has numerous existing natural landslide and other unstable areas. These natural features would contribute to future changes in the topography of the area. No cumulative impacts to the topography of the exploration license or the two proposed lease tracts would result from operations of the West Elk Mine.

The effect on topography of Oxbow increasing production to 6 million tons of coal per year would be minimal.

3.2.5 Potential Topographic Mitigation and Monitoring

No additional mitigation and monitoring measures are suggested. Subsidence monitoring is a requirement of the mine permit issued by the Colorado Division of Minerals and Geology (DMG). If surface cracks occur that affect other uses (roads, trails, etc.), the surface management agencies have authority to require timely on-site mitigation. For additional discussion, see Section 3.3.5, Potential Subsidence Mitigation and Monitoring.

3.3 GEOLOGY

Issue: *Identify geologic hazards on the lease sites and the potential for subsidence by underground mining activities. Areas of concern include the potential influence of geologic hazards; the potential for and consequences of subsidence; the effects of mining on the area's geology, including seismicity.*

3.3.1 Introduction

The characteristics of a coal deposit dictate the most economical and practical mining application. See *Appendix E, Mining Economics*. Geologic data and the interpretations form the basis for mine evaluation and mine production by providing coal reserve estimates and geologic structure data (such as dip, faults, fracture patterns, etc.). For underground mining operations, geologic information is also used to assess subsidence.

3.3.2 Affected Environment

3.3.2.1 General Geology

The Iron Point Exploration License area, and the Iron Point and Elk Creek Coal Lease tracts, lie in the Paonia-Somerset coal field which contains medium to high coal development potential deposits. The main coal beds within this area are found in the Upper Cretaceous Mesa Verde Formation, which is overlain by the Tertiary Wasatch formation and underlain by the Upper Cretaceous Mancos Shale. See *Figure 12, Typical Geologic Cross-Section.*

In addition to the sedimentary units in the region, isolated igneous intrusions have been encountered. Iron Point, located in Section 27, T12S, R91W, is an example of an igneous intrusion. Geologic data indicates that another intrusion has compromised the coal in the northwest portion of the Iron Point Coal Lease Tract. Please refer to Section 2.6.2, Alternative D - Offer the Iron Point Lease Tract With the Stipulation That There be no Subsidence in Sensitive Areas.

The coal bearing sedimentary strata of the Mesa Verde Formation are relatively flat lying with a regional dip of approximately five degrees to the north/northeast. Local dips can vary.

The principal mineable coal seams on the Iron Point Coal Lease Tract are the “D" seam and the “B” seam. Other seams within the tract, A, C, and E, are either considered too thin (less than 6 feet) or are too discontinuous to mine. In the case of the “B” seam, there has been historic mining of this seam within the Iron Point Tract. The overburden overlying the D seam in the Iron Point Coal Lease Tract is generally greater than 500 feet, with the exception of areas under and immediately adjacent to Hubbard Creek. In the northern part of the tract, overburden over the D seam is typically over 1,500 feet. The D seam is over 2,000 feet beneath the Terror Creek Reservoir. See *Figure 13, D Seam Overburden Isopach.* Overburden underlying Terror Creek ranges from 500 to 1,200 feet.

The primary mineable coal seam on the Elk Creek Coal Lease Tract is the “D” seam. On this tract, the A and E coal seams are either considered too thin (less than 6 feet) or are too discontinuous to mine. The B and C coal seams on the Elk Creek Tract were historically mined. The overburden overlying the D seam in the Elk Creek Coal Lease Tract is typically greater than 500 feet and reaches over 2,500 feet at the northeastern boundary of the tract. See *Figure 13, D Seam Overburden Isopach.*

Outcropping on both the Iron Point and Elk Creek Coal Lease tracts are the Tertiary Wasatch Formation, Upper Cretaceous Mesa Verde Formation, and Quaternary deposits. The Cretaceous Mancos Shale does not outcrop on the lease tracts but lies below the Mesa Verde Formation. The following is a brief overview of the geologic units in the area:

- **Quaternary Deposits:** The Quaternary deposits are an unsorted mixture of soil and rock formed by various mass-wasting processes such as landslides, earth flows, soil creep, and debris avalanches. These deposits also include slope colluvium and Quaternary unconsolidated deposits derived from the Wasatch Formation.

- **Wasatch Formation (Tertiary):** The Wasatch formation overlies the Mesa Verde Formation. It consists of red and buff shales and red sandstones in the upper part of the formation, and red to gray conglomerates in the lower portion. The Ohio Creek conglomerate, which is the basil conglomerate unit, is a regional marker and commonly referenced geologic mapping datum.

- **Mesa Verde Formation (Cretaceous):** The Mesa Verde Formation is the primary coal bearing formation in this region and conformably overlies the Mancos Shale Formation. It consists of approximately 2,300 feet of interbedded coal seams, sandstones, shales, and siltstones. The Mesa Verde Formation consists of the Barren Member, Paonia Member, Bowie Member, and Rollins Sandstone Member. The Barren Member is approximately 1,600 feet in thickness and contains no coal seams. The Paonia Member ranges from approximately 300 to 500 feet and is composed of shales and interbedded sandstone. The Paonia Member contains the D and E coal seams. The Bowie Member ranges from 270 to 350 feet thick and consists primarily of grey shales, interbedded lenticular sandstones, and coal seams. The Bowie Member contains the A, B, and C coal seams. The Rollins Sandstone ranges from 120 to 200 feet in thickness. It is a massive, cross-bedded medium to coarse grained, buff to white sandstone unit. The Rollins Sandstone lies conformably on the underlying Mancos Shale and is relatively continuous throughout the area, thus serving as a common marker bed.

- **Mancos Shale (Cretaceous):** The Mancos Shale is a regionally extensive bed of marine shales ranging up to 4,000 feet in thickness. In the lease tracts, it underlies the exposed geologic sequence. However, west of the town of Somerset, the North Fork of the Gunnison River has cut through the upper portion of the Mancos Shale, exposing the grey marine shales so prominent with this formation.

A northwest trending fault may be present in the Iron Point Coal Lease Tract. Other undetected faults may also occur. Faults in the area have been observed to have steep dips, ranging from about 75 degrees to vertical.

3.3.2.2 Geologic Hazards

As discussed in Section 3.2, Topography/Physiography, the area within and surrounding the Iron Point Exploration License area and the two coal lease tracts, have numerous existing natural landslide areas and other unstable slopes. See *Figure 11, Geologic Hazards Map.*

The geologic hazards have been mapped in accordance with state of Colorado House Bill 1041 (C.R.S. 1973, 24-65.1-101, *et. seq.*). As defined in House Bill 1041, a geologic hazard means "a geologic phenomenon which is so adverse to past, current, or foreseeable construction or land use as to constitute a significant hazard to public health and safety or to property." House Bill 1041 also points out that geologic hazards, which are a normal dynamic process, can be intensified or lessened by human activity. In any event, regardless of the intensity, hazards should be recognized and considered prior to any land use changes.

Most of the geologic hazards observed in the exploration license area and coal lease tracts are historic in nature. However, during periods of high to very high precipitation in the mid 1980s, there was renewed movement of existing landslides and the development of new landslides in on unstable slopes. Such areas of recent movement have been identified on *Figure 11, Geologic Hazards Map.*

3.3.2.3 Other Geologic Resources

The lands in the area have been rated as having high potential for oil and gas (Colorado Oil & Gas Potential Map, BLM, 1991). The project area is close to the edge of the productive basin and exploration interest in the past has been low. The potential for the discovery of conventional resources of oil and gas under the Iron Point and Elk Creek Coal Lease tracts appears to be very slight. Dry wells have been drilled to the Dakota Sandstone a few miles to

the southwest and to the northwest of the lease tract areas. There are no oil and gas leases located on or near the exploration license area or the lease application tracts. Methane is found in the coal seams and is released with mining to the surface for the safety of the mining operation. Recently, there have been expressions of interest for leasing oil and gas filed in the area. Interest in coal bed methane has never been high in the immediate area, however, the expressions of interest in leasing are presumed to be associated with coal bed methane.

Other coal seams in the project area are not considered economically recoverable.

3.3.3 Environmental Consequences

There would be negligible effect to the geologic resources as a result of drilling activities in the exploration license area.

If leasing and mining proceeds on the Iron Point and Elk Creek Coal Lease tracts, coal would be removed, and the overlying overburden material would be altered through subsidence. The coal would be extracted, and the existing geologic structure and lithologic continuity in the area above the mined coal would be altered by subsidence. See *Appendix F, Overview of Underground Coal* Mining and *Appendix K, Subsidence Evaluation*.

Any oil and gas resources in the coal seams would be lost. Recoverability of any oil and gas resources present in geologic formations below the coal seams would be reduced.

There are no indirect effects to geologic resources expected for any of the alternatives.

3.3.3.1 Effects of Alternative A (No-Action)

If the No-Action Alternative is selected, coal would not be disturbed by exploration and would not be mined in the lease tracts. The coal resource and the structural and lithologic integrity of the Iron Point and Elk Creek Coal Lease tracts would remain in-place. The potential to recover the coal resource at some time in the future would remain.

3.3.3.2 Effects Common to All Action Alternatives

Direct Effects - Under all alternatives, coal would be mined by longwall techniques. After coal recovery, the overburden would be altered due to subsidence. See *Appendix K, Subsidence Evaluation*. Subsidence would occur due to the extraction of coal on retreat from the longwall panels. There would be a gradual lowering of the surface after the longwall shearer removes the coal. Some cracking would be evident as the shearer passes, and along the fringes of the extracted panel. However, due to the thickness of the overburden in the two lease tracts, it is anticipated that subsidence would not be easily evidenced to casual observers. Rock falls at the outcrop could occur, but the historic (pre-mining) burning of the coal along the outcrop (causing the reddish coloration in the strata in the valley) would preclude a significant amount of mining close to the outcrop. Therefore, rock falls induced by subsidence would be unlikely. There is a potential that mining subsidence could aggravate existing landslides and other geologic hazards in the Hubbard Creek drainage. See *Figure 11, Geologic Hazards Map*.

The relative potential of mine subsidence is graphically illustrated on *Figure 14, Subsidence Potential Map*. This map represents a compilation of the overburden depth to the D coal seam in relation to the geologic hazards of the area, as shown on *Figure 11, Geologic Hazards Map*. Typically, those areas showing "high to very high" subsidence potential are those under 500 feet of overburden combined with areas that presently exhibit landslide, rock falls, or other geologically unstable stratum. The potential impacts are lessened with the depth of

overburden, with potential subsidence impacts of "low to very low" being typically those areas greater than 1,500 feet of overburden. The impact zones shown on *Figure 14, Subsidence Potential Map*, are based on conservative assumptions. The actual impacts may be less than suggested on the map.

The duration of subsidence resulting from mining is composed of both an active and residual phase. Active subsidence refers to movements occurring simultaneously with the mining operations, while residual subsidence is that part of the surface deformation that occurs following the cessation of mining.

Time spans during which surface subsidence may occur vary with the mining method being used. Longwall mining induces subsidence rapidly, beginning almost immediately after mining. With room-and-pillar mining, major occurrences of surface subsidence may be delayed for decades until the support pillars have substantially deteriorated and collapsed. See *Appendix F, Overview of Underground Coal Mining*.

The duration of residual subsidence movements above longwall panels is relatively short, typically varying from a few weeks up to 10 years. On the other hand, in room-and-pillar mining, without pillar recovery, the magnitude of active subsidence is generally small, and the ground surface may experience a variable frequency of subsidence incidents during this pillar period. Sometime after room-and-pillar mining, however, complete collapse of abandoned pillars in the adjacent strata may occur as a result of natural causes or human activities. These processes are likely to continue until all the voids created by mining excavation have been filled by caved stratum. Consequently, in the case of room-and-pillar mining, the residual subsidence can result in subsidence measured on the surface.

Residual subsidence from historic room-and-pillar mining has and will continue to create mining induced seismic events in the area. For example, seismic events from the now abandoned Somerset Mine have been measured on the Richter Scale at the U.S. Geological Survey (USGS) Earthquake Center in Golden, Colorado. See *Appendix K, Subsidence Evaluation*.

Mining induced seismic events as a result of longwall mining may occur. Based on existing information, these events are not expected to cause damage to surface resources or overlying structures. However, this is difficult to quantify given the existing data and research available.

Indirect Effects **-** Mining of the coal seam(s) would result in the loss of any methane within the coal bed. Recoverability of any oil and gas resource present in geologic formations below the coal seams would be reduced due to the limiting of drill pad locations. Total loss of the resource would not occur because of the possibility to directionally drill into the lower horizons.

There are a number of landslides and other unstable slopes in the North Fork Valley region. See *Figure 11, Geologic Hazards Map*. Subsidence beneath such steep slopes could contribute or aggravate landslide movements, but this determination is difficult to quantify given the natural (pre-mining) geologic instability in many areas of the North Fork of the Gunnison River Valley. See discussion in Section 5.0, Topographic Factors Affecting Subsidence, in *Appendix K, Subsidence Evaluation*.

3.3.3.3 Effects of Alternative B

The effects of Alternative B would be the same as those described in Section 3.3.3.2, Effects Common to All Action Alternatives.

3.3.3.4 Effects of Alternative C

The impacts of Alternative C would be similar to those described in Section 3.3.3.2, Effects Common to All Alternatives, with the exception that the amount of subsidence anticipated with multiple seam mining of the Iron Point Coal Lease Tract would be slightly greater than those of Alternative B. Even with multiple seam mining, the subsidence should be fairly uniform over the entire lease tract. Overburden deformation (i.e., fracturing) can migrate further into the overburden with multiple seam coal mining. See *Appendix K, Subsidence Evaluation*.

3.3.3.5 Effects of Alternative D

Effects would be similar to Alternative C, except that special subsidence protection (i.e., barrier pillars, buffer zones, etc.) would be required for those areas under and immediately adjacent to Hubbard Creek, Terror Creek, and the Curecanti-Rifle 230/345 kV electric transmission line.

In terms of the acreage involved, the lease areas under Alternative C are approximately 673 acres (approximately 10 percent) greater than under Alternative B. Therefore, a somewhat larger acreage could be subject to the effects of subsidence.

3.3.4 Cumulative Impacts

A considerable amount of the area in the North Fork of the Gunnison River Valley near Somerset has been mined by historic mining activities. See *Appendix G, Historic Coal Mining Activity*. There has been subsidence in a number of the areas above the historic mining; however, there has been no known damage to resources or overlying structures attributable to this subsidence. In some cases, near the coal subcrop areas, where overburden material is minimal, subsidence may have contributed or aggravated landslide movements, but this determination is difficult to quantify given the natural (pre-mining) geologic instability in many areas in the North Fork of the Gunnison River Valley.

The effect on geology increasing production to 6 million tons of coal per year on the Elk Creek Coal Lease Tract would be minimal.

3.3.5 Potential Subsidence Mitigation and Monitoring

Subsidence monitoring and mitigation programs acceptable to the Colorado DMG and OSM would be implemented for both coal lease tracts. The monitoring and mitigation measures for subsidence are set forth in *Table 3.3-1, Potential Mitigation and Monitoring Measures for Subsidence*.

The Colorado DMG requires detailed information, monitoring, and repair of subsidence impacts as set forth in Section 2.05.6(6), Subsidence Survey, Subsidence Monitoring, and Subsidence Control Plan, of the Regulations of the Colorado Mined Land Reclamation Board for Coal Mining. These regulations have been in force for Colorado since 1980.

3.4 SOILS

Issue: *Identify and protect soil resources for future reclamation uses. Provide for reclamation of areas disturbed by surface facilities.*

Table 3.3-1 Potential Mitigation and Monitoring Measures for Subsidence				
Code	**Impacts Mitigated**	**Potential Mitigation and Monitoring**	**Effectiveness[1]**	**Who[2]**
S-1[3]	Provide inventory of all structures and renewable resource lands above and adjacent to planned underground mining	Prepare report with maps describing structures and renewable resources	1	Colorado DMG
S-2	Provide monitoring before, during, and after mining to assess subsidence impacts	Install a network of subsidence monitors prior to mining	1	Colorado DMG
S-3	Provide detailed information on subsidence to fully understand impacts of underground mining	Prepare subsidence survey report and subsidence control plan	1	Colorado DMG
S-4	Prevent damage to structures and renewable resource lands above and adjacent to actual underground mining	Take appropriate measures to restore, rehabilitate, replace structures impacted by subsidence. Purchase structures prior to mining. Obtain non-cancelable insurance policies payable to surface owners.	1	Colorado DMG Mining company

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk creek Coal Lease tracts, respectively.

3.4.1 Introduction

Soils information and technical data were taken from two soil surveys completed for the project area. An Order III soil survey, entitled Soil Survey of Grand Mesa-West Elk Area (Cryer and Hughes, 1997) was used to characterize and describe the soils overlying that portion of the project area administered by the Forest Service. A soil survey completed by the Natural Resources Conservation Service (formerly the Soil Conservation Service), entitled Soil Survey of Paonia Area, Colorado (Hunter, 1981) was obtained and used to describe and characterize the soils overlying the privately held and BLM-administered lands within the project area boundary. These surveys each contain soil maps depicting the areal extent of the soils delineated as well as map unit descriptions, typical pedon descriptions, and interpretation tables which were used to develop the text presented below. These two soil surveys were not correlated, and the map unit boundaries merging along federal and private land boundaries do not necessarily meet. No site-specific soil baseline studies were conducted for the coal lease or exploration license areas as a part of this project nor are any other relevant soil reports known to exist which could provide applicable soils baseline information.

3.4.2 Affected Environment

3.4.2.1 General Soil Properties

A total of 32 soil map units, characterized by 38 soil series, families or miscellaneous groupings, were delineated within the project area. These soils are forming in response to the wide variety of parent materials, elevations, slopes, aspects, and rates of material weathering common to the project area as a whole. Consequently, these soils exhibit a wide variety of

characteristics in terms of soil properties and use interpretations. *Figure 15, Soil Map*, depicts the 32 soil map units delineated.

Soils overlying mountain side slopes and toe slopes are developing in residuum and colluvium from sandstone and shale sources, as well as from some mixed alluvium parent materials. These soils occur on slopes typically ranging from 20 to 70 percent and are primarily deep to very deep, well drained, and have moderate to high available water capacities. Soil textures are highly variable ranging from loams to very stony clays for surface soils and from loams to very cobbly clays for subsurface soil horizons. Coarse fragment percentages increase with depth. The mass movement potential is rated as moderate to high for most of these map units, though low ratings are common for lesser slope angles.

Soils of canyon, mesa, ridge, mountain, and valley side slopes are highly variable given the broad topographic range of this grouping. Parent materials include interbedded sandstones, shales, and mixed igneous rock types. Slopes range from 5 to 90 percent. These soils are shallow to very deep, well drained, and typically exhibit low to medium available water capacities. Surface textures range from clay loams to extremely stony loams while subsurface textures range from stoney sandy loams to very cobbly clays. The mass movement potential is low to high given the broad slope range.

Deep to very deep, well drained soils with low and moderate available water capacities typify mesa summits, ridges, benches and side slopes of the project area. Interbedded limestones, shales, and basalts are the dominant parent materials underlying slopes ranging primarily from 15 to 65 percent. Surface soil textures range from sandy loams to gravelly loams while subsoil textures range from sandy loams to very stoney clays and extremely cobbly sandy loams. The mass movement potential ranges from low to high depending, in part, on slope percentage.

Soils of mountain slopes and benches are forming in residuum and colluvium derived from sandstones, shales, and basalts. Igneous parent materials may also be present in some cases. Slopes range from 5 to 65 percent. These soils are deep to very deep, well drained, and exhibit medium available water capacities. Surface textures are typically loams and clay loams while subsurface textures range from loams to very stony clays. The mass movement potential is typically low to medium.

Shallow to deep, well drained soils with low to high available water capacities typify the uplands and associated mountain side slopes of the project area. Sandstones, shales, and mixed alluvium are the dominant parent materials on slopes ranging from 5 to 25 percent. Surface soil textures are loams and clay loams while subsoil textures range from clay loams to channery loams. The mass movement potential was not rated for these soils.

Soils overlying uplands, valley side slopes and alluvial valleys are forming in sandstone materials, eolian deposits, and mixed alluvium. Slopes range from 6 to 65 percent. These soils are typically deep and well drained with high available water capacities. Surface textures are loams while subsurface textures range from channery clay loams to clays. The mass movement potential was not rated for the soil portions of these map units.

Deep, well-drained soils with moderate to high available water capacities overlie the fans and associated landforms of the project area. Alluvium and landslide materials from mixed rock sources are the dominant parent materials. Slopes range from nearly level to 40 percent with lesser slopes predominating. Soil textures range from loams to stony loams for surface soils and from clays to extremely cobbly loamy sands for subsurface soil horizons. The mass movement potential is rated as low to medium.

Rock outcrops occur across the project area and are expressed as bare rock exposures of canyon walls, escarpments, and very steep upland side slopes. Little in the way of soil is included in these map units.

3.4.2.2 Soil Salvage and Reclamation Suitability

Soil salvage depths were selected considering the limited disturbances proposed. It is assumed that for the majority of disturbances, unsalvaged subsoils would remain in place and be available as a subgrade growth medium following facility decommissioning. Map unit slopes were not considered since the range of slopes within a map unit often includes slope angles both accessible and inaccessible to salvage equipment.

The soils overlying the project area exhibit a comparatively narrow range of characteristics with respect to salvage suitability. Proposed total salvage depths typically range from 10 to 24 inches and include both surface and subsurface soil materials. The main constraints to deeper soil salvage across the coal lease and exploration license areas relate to physical soil characteristics and include high subsoil coarse fragment content (>35 percent by volume) and high clay content (clay textures). Low pH values (<6.0) and shallow depths to bedrock also constrain salvage depth for a number of map units.

The in-place reclamation suitability of the soil map units of the lease areas range from low to high given typical soil characteristics and the slope angles upon which the soils are present. Soil chemical characteristics are not normally limiting with respect to reclamation suitability. Soil physical characteristics such as surface stones, slow permeability, clayey textures, and low available water capacity limit the suitability of several units. Topographic and related factors such as slope and erosion potential, respectively, also limit the suitability of many of the coal lease tracts and exploration license area map units.

3.4.2.3 Erosion Hazard

Erosion hazard of the soils present is highly variable. Generally, as slope increases, water erosion hazard increases. Map units having slopes of approximately 25 percent or less typically have a low or medium hazard, while steeper slopes have medium to high hazards.

Rock outcrops and rubble areas also have low water erosion hazard ratings. The hazard of wind erosion is slight for the vast majority of these map units.

3.4.3 Environmental Consequences

Approximately 33.5 acres (see Section 2.4, Alternative B) would be directly impacted by the construction of various boreholes, shafts, light-use access roads, and drill pads associated with surface activities and exploration. These soils, given the variability of the project area in terms of parent materials, slope, aspect, etc., are highly variable in and of themselves with respect to chemical and physical characteristics. Suitable salvage depths are comparatively shallow with deeper salvage typically constrained by high coarse fragment contents and heavy clay textures.

Direct impacts to soils include the salvage and stockpiling of selected surface soils for later re-application, compaction, and erosion. Given the size and form of the individual facilities making up the proposed disturbed acreage, as well as the regulatory requirements for revegetation, the direct impacts to soils are limited and considered to be short-term and mitigable. The proposed disturbance of 33.5 acres represents an increase of 10 percent over the acreage of soils disturbed by coal operation in the project area to date, and less than 1 percent of the acreage included in the lease tracts and exploration license area as a whole. The sole indirect impact to

soils, potential subsidence-induced cracking, would have a limited surface impact on the soil resource. Soil cracks tend to heal naturally and represent a short-term disturbance.

3.4.3.1 Effects of Alternative A (No-Action)

Under the No-Action Alternative, the project area would essentially remain in its endemic state supporting current land uses. No direct or indirect affects associated with the reasonable foreseeable actions listed for either lease area or the exploration area are anticipated. Future impacts to soils would parallel historic impacts barring any unforeseen future developments or changes in grazing or timber harvesting policies.

3.4.3.2 Effects Common to All Action Alternatives

Direct Effects - Direct impacts to soils under all alternatives would result from the development of exploration and degasification boreholes, exhaust and ventilation shafts, and construction of any necessary spur roads to access these facilities. A total of 33.5 acres of surface soils, at a maximum, would be affected by these actions as depicted in *Table 3.4-1, Acreage of Potential Disturbance by Facility Type-All Alternatives.*

Table 3.4-1
Acreage of Potential Disturbance by Facility Type - All Alternatives

Proposed Lease Element	Exploration Boreholes	Degasification Boreholes	Exhaust Shafts	Ventilation Shafts	Roads
Iron Point Exploration Area	6.5*	NA	NA	NA	5.0
Iron Point Lease Area	NA	2.0	3.0	NA	5.0
Elk Creek Lease Area	NA	4.0	NA	1.0	7.0
Totals	**6.5**	**6.0**	**3.0**	**1.0**	**17.0**

* Includes five holes that are within the potential boundary of the Iron Point Coal Lease Tract.

Impacts to the soil resource include those which would affect the chemical, physical, and microbial nature of endemic soil materials. Erosion is a potential impact which must also be considered. Soil chemical parameters would be permanently modified as a result of any soil salvage program whereby surface soils would be stockpiled or wind-rowed along the borders of areas to be disturbed by various shafts, boreholes, and road construction. Surface soil horizons would be mixed during stockpiling or windrowing resulting in a blending of characteristics as compared to the soils in their natural state. Soil chemistry would also be modified through stockpiling as anaerobic conditions within the stockpiles develop. The volume of soil to be stockpiled would be limited, and the time the soils would exist in such stockpiles would be comparatively short for most disturbances. Therefore, changes in soil chemistry due to this activity are considered to be short-term and redeemable to a level commensurate with vegetation establishment following resoiling.

Isolated spill accidents, should they occur, could result in minor soil contamination from oils, solvents, etc. Soils so affected can be buried to effectively reduce the effects of this impact. The volume of soil subject to spills should be limited, however, given the plan to stockpile suitable surface soils prior to operational disturbances. No impact to revegetation potential is anticipated.

A number of soil physical characteristics such as structure, texture, and rock fragment content would be permanently modified through blending during stockpiling and soil replacement operations. Given that only suitable soils would be salvaged, this is not considered to be a negative impact. Compaction in heavily trafficked, operational areas would likely reduce the aeration, permeability, and water-holding capacity of impacted soils. Ripping and similar surface manipulations are proposed as a part of the reclamation plan to address compaction concerns. The effects of compaction would be reduced to a short-term impact through the proper application of such techniques, and natural freeze-thaw cycles, over time.

Soil microbial and fungal populations could also change resulting in a potential loss of nitrifying bacteria and mycorrhizal species due to stockpiling. Microbial and fungal populations should reestablish over time, typically through natural invasion via wind, drainage water, and animal vectors from nearby adjacent undisturbed areas. This is a generally accepted premise in the west based on observations of previously mined and reclaimed areas where stockpiled soil has been respread and revegetation has been successful. It is particularly true for these proposed disturbances given their limited individual sizes and, in the case of roads, a linear form. This is considered to be a short-term, mitigable impact with no reduction in reclamation potential expected.

Wind erosion is not expected to occur on exposed areas where salvageable soil has been removed. The potential for wind erosion on the project area is low due to the surrounding topography, comparatively dense endemic vegetation communities, and the surface soil rock fragment content. It may also be noted that the expected disturbances are comparatively small and narrow, a condition not conducive to the forces of wind erosion. In addition, temporary soil stockpiles would be stabilized following stockpiling operations and all disturbed areas would be revegetated following decommissioning.

The potential for soil erosion by water ranges from "low" to "high" across the soils of the coal lease tracts and exploration license area. Grading to permit facility construction would typically occur on slopes less than 40 percent and result in nearly level construction areas having comparatively short slope lengths. Such conditions result in a low short-term potential for water erosion for any soils impacted by various shafts and boreholes. Construction of spur roads to shaft and drill pad areas would also result in a low short-term erosion potential for these same reasons. All disturbances of this nature must be reclaimed per state and federal regulations following decommissioning. The small acreages and short slopes involved, coupled with required soil salvage, result in a moderate to high revegetation potential for all surface disturbances.

***Indirect Effects* -** Indirect effects are discussed below by alternative.

3.4.3.3 Effects of Alternative B

Other than the direct affects discussed above, the only additional indirect potential impact to the soil resource is from subsidence, stemming from underground longwall mining operations. The effect of subsidence would manifest itself as cracks forming on the soil surface followed by a slumping, or settling, of the ground elevation as the geologic strata cave, at depth, behind the retreating longwall operation. Some cracks would remain on the surface at the conclusion of mining. These cracks typically occur on the surface over gate roads and the edges of longwall panels. These cracks would not likely be visible to any degree due to the existing vegetation and the propensity of these cracks to naturally fill. The acreage of soil which would be denuded by cracking cannot be calculated but would likely be minimal considering the acreage involved. It is unlikely that a measurable volume of soil would be lost to erosion given the linear nature

and short slope lengths of these features. Similarly, no measurable decrease in soil productivity is expected.

3.4.3.4 Effects of Alternative C

Compared to Alternative B, the affects of subsidence under this alternative would be greater given the somewhat larger lease area involved, along with the employment of multi-seam mining activities. With multi-seam mining, the depth to which geologic strata cave behind the retreating longwall machine would be greater which, in turn, could result in deeper surface cracks. In terms of the acreage involved, the lease areas under Alternative C are approximately 673 acres (approximately 10 percent) greater than under Alternative B. Therefore, a somewhat larger acreage could be subject to the effects of subsidence.

3.4.3.5 Effects of Alternative D

Alternative D is identical to Alternative C except that special subsidence protection would be required under specific areas such as Terror Creek, Hubbard Creek, or the Curecanti-Rifle 230/345 kV electric transmission line. Therefore, the effects to soils as a result of multi-seam mining would be the same, only over a slightly smaller lease area.

3.4.4 Cumulative Impacts

The acreage of soils proposed to be affected by surface disturbances on the coal lease tracts and exploration license areas totals approximately 33.5 acres. Approximately 70 acres of previous disturbances are associated with the existing Bowie No. 2 Mine with an additional 10 to15 acres of disturbance planned under other proposed permits. At the Sanborn Creek Mine, approximately 95 acres have been disturbed and an additional 15 acres of disturbance is planned for the Elk Creek portal area. Therefore, the acreage of soils proposed to be directly affected by any alternative under consideration represents an increase in disturbed area of approximately 10 percent. The proposed disturbances equal less than 1 percent of the total acreage involved with the exploration license area and coal lease tracts. The impacts related to subsidence would not measurably increase these acreage relationships.

The effect on soils of increasing production to 6 million tons of coal per year on the Elk Creek Coal Lease Tract would be minimal.

3.4.5 Potential Soils Mitigation and Monitoring

Proper soil management and reclamation measures are required by the surface management agencies on disturbed sites. Colorado DMG would also require proper soil management procedures as part of their exploration and mine permits. See *Table 3.4-2, Potential Mitigation and Monitoring Measures for Soils.*

Table 3.4-2 Potential Mitigation and Monitoring Measures for Soils				
Code	**Impacts Mitigated**	**Potential Mitigation and Monitoring**	**Effectiveness[1]**	**Who[2]**
SO-1[3]	Preserve soil for future reclamation activities	Removal of soil ahead of disturbance; stockpile to prevent wind and water erosion; redistribute for reclamation.	1	BLM Forest Service Colorado DMG
SO-2	Prevent soil loss	Design disturbance to prevent/control erosion	1	BLM Forest Service Colorado DMG
Notes: 1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain. 2. This is the entity with jurisdiction or authority to implement this action. 3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk creek Coal Lease tracts, respectively.				

SO-1 - The proper removal, storage and redistribution of soils would be effective in preserving soil for use in future reclamation activities.

SO-2 - Design of surface disturbance should prevent and control erosion and soil loss (eg, water bars, straw bale dikes, diversion ditches, sediment ponds, etc). Such control measures should be effective when installed and maintained properly.

3.5 SURFACE WATER HYDROLOGY

***Issue:** Identify and minimize impacts to water quality and hydrology to maintain the integrity of watersheds within and surrounding the lease tract areas. Maintain adequate flows to drainages and ditches above underground mining activity. Areas of concern include: the potential to alter existing hydrologic systems; the potential to impact irrigation canals and the Terror Creek Reservoir by subsidence; alteration of downstream flow rates; alteration of existing springs and seeps; changes in surface water chemistry as a result of mining operations; and, impacts to water rights on Terror Creek, Hubbard Creek, Bear Creek, and Elk Creek.*

3.5.1 Introduction

The study area required to address the impacts to surface water hydrology from leasing the Iron Point and Elk Creek Coal Lease tracts and the Iron Point Exploration License area is defined by the watershed boundaries of the local drainages (Figure 16, Regional Hydrology Map). The following sections include discussion of the regional hydrologic setting, flow characteristics within the surface drainage system, analysis of surface water quality, water rights, and environmental consequences of exploration and mining on surface water resources.

The following information sources were used for this evaluation:

- Surface water quality and quantity data for regional hydrology from the USGS;
- Surface water quality and quantity data for the Iron Point and Elk Creek Coal Lease tracts and the Iron Point Exploration License area from Bowie and Oxbow;
- Surface water rights information for the drainages in the vicinity of the study area from the Colorado State Engineers Office, Division of Water Resources; and,

- Review of Bowie and Oxbow data, including annual hydrology reports, permit applications, and other reports related to surface water hydrology.

To respond to issues raised during scoping, effects of subsidence on Terror Creek Reservoir were included in the analysis. It should be noted that the Terror Creek Reservoir is not within the proposed Iron Point Coal Lease Tract and is outside the area of influence defined by the subsidence angle of draw. See *Figure 14, Subsidence Potential Map*, and *Appendix K, Subsidence Evaluation.*

3.5.2 Affected Environment

The Iron Point and Elk Creek Coal Lease tracts and the Iron Point Exploration License area are located within the North Fork of the Gunnison River basin.

3.5.2.1 Regional Surface Water Hydrology

The North Fork of the Gunnison River drains the coal lease and exploration license areas. The North Fork of the Gunnison River joins the Black Canyon of the Gunnison River downstream of the Hotchkiss fish hatchery to become the Gunnison River.

There are two USGS monitoring locations along this reach: North Fork of the Gunnison River near Somerset, Colorado (Station No. 09132500), and North Fork of the Gunnison River below Leroux Creek, near Hotchkiss, Colorado (Station No. 09135950).

Stream flow has been monitored at the station near Somerset since October 1933. The drainage area at the Somerset station is 526 square miles. The highest annual mean flow at this station during the period of record for water years 1934 through 1997 was 829 cfs in 1984.

The highest instantaneous peak flow of 9,220 cfs was recorded on May 24, 1984. The lowest annual mean flow for the same station and period of record was 114 cfs in 1977.

The station below Leroux Creek is a new station with data collected for a three month period during the summer of 1997. Flow during the period from July to September ranged from a minimum daily mean of 94 cfs to a maximum daily mean of 848 cfs. (USGS, 1997)

Surface water quality in the North Fork of the Gunnison River in the vicinity of Paonia is good with low concentrations of TDS, nitrate, nitrite, and metals. The water is of calcium bicarbonate type.

3.5.2.2 Project Area Surface Water Hydrology

The coal lease tracts and exploration license area are tributary to the North Fork of the Gunnison River between Somerset and Paonia, Colorado. *Figure 16, Regional Hydrology Map*, shows the watershed areas that encompass the coal lease tract and exploration areas. *Figure 17, Regional Stream Network*, illustrates the relative location of the tributary streams to the North Fork of the Gunnison River. Hubbard Creek and Terror Creek drain the Iron Point Exploration license area and the Iron Point Coal Lease Tract. Hubbard Creek, Bear Creek, and a small portion of Elk Creek drain the Elk Creek Coal Lease Tract.

Watershed (drainage basin) information used to characterize the streams draining the project area includes: drainage area, elevation range, stream length, and stream order. Drainage area is the area of the watershed from its headwaters to its confluence with the next lower stream. Elevation range is determined from the highest point in the watershed to the elevation at the

confluence with the next lower stream. Channel length is the total length of the stream from its origin at the headwaters to its confluence with the next lower stream. Stream order is a classification of a watershed using the number of tributaries found within the watershed. A first order stream has no tributaries. A second order stream is a reach downstream of the confluence of at least two first order streams. Ordering continues in this fashion indicating the relative complexity of the watershed.

Iron Point Exploration License Area and Coal Lease Tract - Hubbard Creek is a fourth order perennial drainage that has an estimated drainage basin area of 58.1 square miles. Elevation ranges from 11,327 feet on Electric Mountain to 5,870 feet at the confluence with the North Fork of the Gunnison River. The main channel length is 17.60 miles long. Approximately 20 percent of the Hubbard Creek drainage basin lies within the coal lease tract and the exploration license areas. An area of 1.3 square miles is located within the Elk Creek Coal Lease Tract. A 3.3 square mile area is located within the Iron Point Coal Lease Tract and a 7.0 square mile area is located within the Iron Point Exploration License area.

Terror Creek is a third order perennial drainage with a drainage basin area of 29.4 square miles. Elevation ranges from 11,200 feet north of Rex Reservoir to 5,740 feet at the confluence with the North Fork of the Gunnison River. The main channel length is 12.35 miles long. Thirteen percent of the Terror Creek drainage basin lies within the coal lease tract and exploration license area. An area of 1.8 square miles is located within the Iron Point Coal Lease Tract. A 1.9 square mile area is located within the Iron Point Exploration License area.

Baseline water quality and flow data for the Bowie No. 1 and No. 2 mines have been collected for several years. Bowie has initiated additional baseline monitoring in the Iron Point Coal Lease Tract and Iron Point Exploration License area, north of the existing mines. *Table 3.5-1, Surface Water Monitoring Summary*, describes the period of record for the surface water monitoring network.

There are twelve surface water monitoring locations on Hubbard Creek and its tributaries. Instantaneous flow data and water quality data are monitored at each location. Surface water monitoring locations are shown on *Figure 16, Regional Hydrology Map*. Surface water flow is discussed in this section, while water quality is addressed in Section 3.5.2.3, Project Area Surface Water Quality.

Iron Point Gulch (D34-12), Dove Gulch (D33-13, D34-13, D34-15), and Sheep Corral Gulch (D2-1, D33-14) have flow monitoring data available from October 1997 through April 1999 (data available at the time of this Draft EIS). Instantaneous flow is recorded at most of these stations in the spring and early summer, and they are dry in the fall and winter months. Lower Dove Gulch (D34-15) is perennial, with flows ranging from 0.5 cfs in June 1998 to 0.03 cfs in September and November 1998.

Flow in Upper Hubbard Creek (Hub-up), located at the mine entrance of the Blue Ribbon Mine, ranges from 3.5 cfs (September 1996) to 86.5 cfs (June 1997). The period of record for this station is September 1996 to December 1998.

Flow in Lower Hubbard Creek (Hub-low), located at the confluence of Hubbard Creek with the North Fork of the Gunnison River, ranges from 2.9 cfs (September 1998) to 85.5 cfs (June 1997). The period of record for Lower Hubbard is also September 1996 to December 1998. The Upper Deertrail Ditch monitoring location (Deer-up) diverts water from Hubbard Creek between the upper and lower stations. Flow and quality are monitored at the headgate of Deertrail Ditch (Deer-up). Flow in the Deertrail Ditch ranges from 0.61 cfs (March 1997) to 4.81 cfs (December 1998). Period of record for this ditch is May 1996 to December 1998.

Upper Freeman Gulch (Free-up) was dry, or had no measurable flow, for the period June 1996 to December 1998. Surface water was measured in Lower Freeman Gulch (Free-low) twice during the June 1995 through December 1998 period of record. Flow on June 17, 1997 was 1.88 cfs and on June 18, 1998 flow was 3.75 cfs.

Lower Deertrail Ditch (Deer-low) is monitored at the downstream end of the Deertrail Ditch where it discharges into the Fire Mountain Canal. The period of record for this station is from May 1996 to December 1998. Flow ranges from 0 cfs in June 1998 and September 1998 to 0.16 cfs on November 19, 1997.

Six monitoring stations measure ephemeral streams that are directly tributary to the North Fork of the Gunnison River. Upper and Lower Stephens Draw, A Gulch, B Gulch, C Gulch and D Gulch are located within the permit boundary of the Bowie No. 2 Mine. These stations were monitored from February 1995 through December 1998. These streams are dry for much of the year. Flow events were captured only in the Lower B and C gulches. These flow measurements are less than 0.01 cfs, and there is no seasonal pattern.

Table 3.5-1
Surface Water Monitoring Summary

Owner/Mine	Drainage	Site Designation	Monitoring Period(s)	Comments
Oxbow/Sanborn	North Fork of Gunnison	NF-1	3/91-12/94	
Oxbow/Sanborn	North Fork of Gunnison	NF-1	3/91-12/94	
Oxbow/Sanborn	North Fork of Gunnison	NF-3	3/91-12/94	
Oxbow/Sanborn	North Fork of Gunnison	E-1	3/80-4/82	Field parameters & flow data
Oxbow/Sanborn	North Fork of Gunnison	E-2	3/80-4/82	Field parameters & flow data
Oxbow/Sanborn	North Fork of Gunnison	B-1	3/80-4/82	Field parameters & flow data
Oxbow/Sanborn	North Fork of Gunnison	B-2	3/80-4/82	Field parameters & flow data
Bowie/Bowie No. 2	Drainage System	A-Gulch-lo	2/95-19/98	Field parameters & flow data
Bowie/Bowie No. 2	Drainage System	B-Gulch-lo	2/95-19/98	
Bowie/Bowie No. 2	Drainage System	B-Gulch-up	2/95-19/98	Field parameters & flow data
Bowie/Bowie No. 2	Drainage System	C-Gulch-lo	2/95-19/98	
Bowie/Bowie No. 2	Drainage System	C-Gulch-up	2/95-19/98	Field parameters & flow data
Bowie/Bowie No. 2	Drainage System	D-Gulch-lo	2/95-19/98	Field parameters & flow data
Bowie/Bowie No. 2	Drainage System	D-Gulch-up	2/95-19/98	Field parameters & flow data
Bowie/Bowie No. 2	Sheep Corral Drainage System	D2-1	10/97-4/99	
Bowie/Bowie No. 2	Terror Creek - Drainage System	D32-4	10/97-11/98	
Bowie/Bowie No. 2	Terror Creek - Drainage System	D32-5	6/98-11/98	
Bowie/Bowie No. 2	Upper Dove Gulch	D33-13	11/98	
Bowie/Bowie No. 2	Upper Sheep Corral Gulch	D33-14	11/98	
Bowie/Bowie No. 2	Iron Point - Drainage System	D34-12	10/97-4/99	
Bowie/Bowie No. 2	Dove Gulch - Drainage System	D34-13	10/97-4/99	

Table 3.5-1
Surface Water Monitoring Summary

Owner/Mine	Drainage	Site Designation	Monitoring Period(s)	Comments
Bowie/Bowie No. 2	Hubbard Creek - Drainage System	D34-14	10/97-4/99	
Bowie/Bowie No. 2	Dove Gulch - Drainage System	D34-15	6/98-11/98	
Bowie/Bowie No. 2	Canal - Deertrail Ditch	Deer-lo	5/96-12/98	
Bowie/Bowie No. 2	Canal - Deertrail Ditch	Deer-up	5/96-12/98	
Bowie/Bowie No. 2	Freeman Gulch - Drainage System	Free-low	6/95-12/98	
Bowie/Bowie No. 2	Freeman Gulch - Drainage System	Free-up	6/95-12/98	
Bowie/Bowie No. 2	Hubbard Creek - Drainage System	Hub-low	6/96-12/98	
Bowie/Bowie No. 2	Hubbard Creek - Drainage System	Hub-up	9/96-12/98	
Bowie/Bowie No. 2	North Fork - Drainage System	NFG-low	9/96-12/98	
Bowie/Bowie No. 2	North Fork - Drainage System	NFG-up	9/96-12/98	
Bowie/Bowie No. 2	Stephens Draw - Drainage System	Steph-low	9/96-12/98	
Bowie/Bowie No. 2	Stephens Draw - Drainage System	Steph-up	7/95-12/98	
Bowie/Bowie No. 2	Canal - Terror Creek	TC-low	9/96-12/98	
Bowie/Bowie No. 2	Terror Creek - Drainage System	TC-up	9/96-12/98	
Bowie/Bowie No. 2	Terror Creek - Drainage System	TC-west	4/97-12/98	

There are four monitoring stations along the Terror Creek drainage. Cottonwood Stomp (D32-5) is located approximately 1 mile downstream of the Terror Creek Reservoir. Monitoring began at this station in June 1998. Four instantaneous flow measurements were taken between June and November 1998. Flow was less than 1 cfs in June and July and dry in September and November. Upper Terror Creek (TC-up) is located on Terror Creek immediately upstream of the confluence with West Terror Creek. It has a period of record from September 1996 through December 1998. Flow ranges from 0 cfs in September 1996 to 44 cfs on April 27,1997. West Terror Creek (TC-west) is located on West Terror Creek immediately above the confluence with Terror Creek. The period of record for West Terror Creek is April 1997 through December 1998. Flow ranges from 0.8 cfs on August 24, 1997 to 198 cfs on April 27, 1997. Lower Terror Creek (TC-low) is located on Terror Ditch below the headgate. The period of record is from September 1996 through December 1998. Flow ranges from 0.1 cfs in April 1998 to 7.9 cfs on June 17, 1998.

There has been timber sale activity in the Hubbard and Terror creek drainages. From 1980 to 1989 approximately 410 acres were harvested in both drainage basins. During the period 1990 through 1999, a total of 491 acres were harvested in the Hubbard Creek drainage. Abram, Little Alder and Hubbard No. 2 were the three timber sales harvested. Abram and Little Alder timber sales are located in the aspen cover type and timbered stands were harvested using the clear-cut method. The Hubbard No. 2 timber sale is located in the spruce-fir cover type and timbered

stands are prescribed to be harvested with an intermediate-partial harvest. Hubbard No. 2 is still under contract and logging activities are expected to continue until 2004. During the same period, 482 acres in the Terror Creek drainage were harvested in the Rebekah, Sarai, Salt Pillar, and Cunningham timber sales. These four sales were in the aspen cover type and were harvested using the clear-cut method. All timber sale activity occurred to the north and west of the Iron Point Lease Tract and the exploration license area. Timber sales over the past 20 years have affected approximately 2 percent of the watershed areas on Hubbard and Terror creeks. Effects to surface water quality and quantity have been minimal.

There has been limited harvesting of several aspen stands within the Bear Creek drainage on the Hotchkiss Ranch Company property in the northern part of the Elk Creek Lease Tract.

Elk Creek Coal Lease Tract - Elk Creek is a third order intermittent drainage that is very narrow and steep-sided. The drainage basin area is 5.6 square miles. Elevation ranges from 9,780 feet near Buck Mesa to 6,000 feet at the confluence with the North Fork of the Gunnison River. The channel length is 5.64 miles. Eleven percent of the Elk Creek drainage basin lies within the Elk Creek Coal Lease Tract. The channel of Elk Creek is primarily located east of the coal lease tract.

Bear Creek is also a third order intermittent drainage and the drainage basin area is 8.7 square miles. Elevation ranges from 9,735 feet near Buck Mesa to 5,930 feet at the confluence with the North Fork of the Gunnison River. The channel length is 7.73 miles. Forty-seven percent of the Elk Creek drainage basin lies within the Elk Creek Lease Tract. A small portion (0.02 square miles) lies within the Iron Point Exploration License area.

Oxbow has collected limited surface water data within the current mine permit area for the Sanborn Creek Mine. *Figure 16, Regional Hydrology Map*, shows the locations of these monitoring points. Monitoring in Elk Creek and Bear Creek was collected by Oxbow in the early 1980s. *Table 3.5-1, Surface Water Monitoring Summary*, describes the period of record for the surface water monitoring network.

There are two surface water monitoring locations on Elk Creek. Station E-1, Lower Elk Creek, is located at the confluence of Elk Creek with the North Fork of the Gunnison River. Station E-2, Upper Elk Creek, is located southeast of the Elk Creek Coal Lease Tract boundary on Elk Creek. The pericd of record available for stations E-1 and E-2 is from April 1980 to April 1982. Frequency of monitoring for E-1 and E-2 was twice a month for the summer of 1980, then monthly (some exceptions in the winter months) through April 1982. Surface water flow for Station E-1 ranges from 0 cfs in March, 1980, and June through August 1981 to 28.9 cfs on May 21, 1980. Surface water flow for Station E-2 ranges from 0.01 cfs in August 1981 to 28.9 cfs on May 21, 1980.

There are two surface water monitoring locations on Bear Creek. Station B-1, Lower Bear Creek, is located at the confluence of Bear Creek with the North Fork of the Gunnison River. Station B-2, Upper Bear Creek is located at a boundary of the Elk Creek Coal Lease Tract as it crosses Bear Creek. The period of record available for stations B-1 and B-2 is from March 1980 to April 1982. Like the Elk Creek stations the frequency of monitoring for B-1 and B-2 was also twice a month for the summer of 1980, then monthly until the spring of 1982. Flow measurements for Station B-1 range from 0.11 cfs in August 1980 to 61.13 cfs on May 21, 1980. Flow measurements at Station B-2 range from 0 cfs in August and September 1980, to 51.35 cfs on May 21, 1980.

3.5.2.3 Project Area Surface Water Quality

Baseline water quality data has been collected on streams within the Iron Point Coal Lease Tract since the mid-1990's. Baseline data collection further upstream into the exploration license area began in 1997. The frequency of monitoring is quarterly, and there is no monitoring in the winter months due to limited access. *Figure 16, Regional Hydrology Map*, shows the location of surface water monitoring stations and *Table 3.5-2, Selected Surface Water Quality Summary*, describes summary statistics for water chemistry collected.

Oxbow has collected water quality data from areas within their current operations. However, Elk Creek and Bear Creek, which are located adjacent to and within the Elk Creek Coal Lease Tract, have limited water quality data available.

Perennial streams in the area, including the North Fork of the Gunnison River, Hubbard Creek, and Terror Creek have been assigned stream classifications by the Water Quality Control Commission, that define standards for water quality. These streams are classified as Class 1 Aquatic Life Cold, Class 1 Recreation (waters where human ingestion of small quantities is likely to occur), Water Supply and Agriculture (CDPHE, 1999).

The following discussion addresses average water quality data and parameters regulated by the Colorado Department of Public Health and Environment standards. Several of the parameters listed in the Colorado Department of Public Health and Environment standards for the North Fork of the Gunnison River are consistently reported at, or below detection limits at most stations collected by Bowie. These parameters are arsenic, cadmium, copper, mercury, molybdenum, and selenium. Concentrations of zinc and lead are reported at, or near detection limits; however, these detection limits are higher than the chronic and acute standards for zinc and lead. Only total iron and total manganese were analyzed at the Oxbow stations on Elk Creek and Bear Creek.

Iron Point Coal Lease Tract and Exploration License Area - The surface water quality in streams that drain the Iron Point Coal Lease Tract and Exploration License area is relatively consistent, with only a few exceptions. Generally, flows in Hubbard and Terror creeks, and the North Fork of the Gunnison River, are calcium bicarbonate type water. Four stations; Iron Point Gulch (D34-12), Dove Gulch (D34-15), Lower Freeman Gulch (Free-low), and Lower Stephens Gulch (Steph-low) are calcium/sodium bicarbonate type with high concentrations of TDS. Metals concentrations at these four stations were below detection limits, or within the state standards for total iron, manganese and selenium with one exception. The Dove Gulch station had a concentration of total iron that slightly exceeded the standard in July 1998.

Water quality data at Lower B and C gulches are calcium/sodium sulfate water types. Water quality at these stations is poor with high concentrations of total dissolved solids (TDS), nitrate, nitrite and sulfate. They also have concentrations of total iron, manganese, selenium and zinc that exceed the state standards. These concentrations are believed to reflect impacts from past mining activity, in particular, the historic waste coal fines and mine portals that are located in the B and C gulches below the Bowie No. 2 Mine.

Water quality data collected from stations on the North Fork of the Gunnison River indicate calcium bicarbonate water type. Stations monitoring water quality on the North Fork of the Gunnison River collect data from points upstream and downstream from mining activity at both the Bowie and Oxbow mines.

The monitoring stations on the North Fork of the Gunnison River monitored by Bowie are designated NFG-up, Upper North Fork of the Gunnison River, and NFG-low, Lower North Fork

Table 3.5-2
Selected Surface Water Quality Summary

	Temperature (°C)	Field pH	Bicarbonate (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)	Aluminum (T) (mg/l)	Iron (T) (mg/l)	Lead (T) (mg/l)	Manganese (T) (mg/l)	Selenium (T) (mg/l)	Zinc (T) (mg/l)
Water Quality Std. (mg/l)		6.5 - 8.5		10.00	0.05	500		250	0.20	1.00	Varies	0.050	0.020	Varies
Hubbard Creek above Iron Point (D34-14)														
Number of Samples	6	6	5	1	1	5	6	5	5	5	5	5	5	5
Minimum	3.2	7.1	74	0.06	-0.01	100	-5	-10	0.05	0.15	-0.04	0.008	-0.001	-0.010
Maximum	19.3	6.3	124	0.06	-0.01	160	6	20	1.16	0.96	-0.04	0.017	-0.001	0.020
Average	10.0	7.6	97	0.06	-.0.1	136	5	9	0.32	0.37	-0.04	0.013	-0.001	0.008
Standard Deviation	6.6	0.5	21	0.00	0.00	23	3	7	0.48	0.34	0.00	0.004	0.000	0.007
Hubbard Creek below Blue Ribbon														
Number of Samples	9	9	6	5	5	6	6	6	6	6	6	6	6	6
Minimum	0.5	8.1	57	-0.02	-0.01	100	-5	-10	0.07	0.11	-0.02	0.005	-0.001	-0.010
Maximum	17.1	9.0	137	0.06	-0.01	160	38	10	2.25	1.65	-0.04	0.035	-0.040	0.040
Average	7.9	8.5	106	0.03	-0.01	140	12	8	0.69	0.84	-0.02	0.017	-0.004	0.016
Standard Deviation	5.9	0.3	32	0.02	0.00	32	13	3	0.89	0.62	0.01	0.011	0.006	0.014
Hubbard Creek at Confluence (Hub-low)														
Number of Samples	10	10	6	5	5	6	6	6	6	6	6	6	6	6
Minimum	2.3	8.1	62	-0.02	-0.01	100	-5	-10	0.05	0.09	-0.02	0.009	-0.001	-0.010
Maximum	20.0	9.3	155	0.29	-0.01	260	34	50	1.91	1.44	-0.08	0.034	-0.020	0.040
Average	10.1	8.6	115	0.07	0.006	165	13	20	0.64	0.59	-0.02	0.017	-0.005	0.016
Standard Deviation	6.7	0.4	35	0.12	0.002	55	12	18	0.81	0.53	0.01	0.009	0.006	0.014
Upper Deertrail Ditch (Deer-up)														
Number of Samples	12	12	6	7	7	8	8	8	8	6	8	8	8	8
Minimum	2.0	6.0	51	-0.02	-0.01	50	-5	-10	0.08	0.13	-0.02	0.008	-0.001	-0.010
Maximum	19.6	9.1	139	0.08	0.02	200	52	20	2.03	1.85	0.05	0.033	-0.040	0.030
Average	10.2	6.6	95	0.03	0.008	126	18	10	0.90	0.85	0.02	0.022	-0.003	0.016
Standard Deviation	6.6	0.4	38	0.03	0.006	46	19	6	0.83	0.65	0.01	0.009	0.007	0.009

Table 3.5-2
Selected Surface Water Quality Summary

	Temperature (°C)	Field pH	Bicarbonate (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)	Aluminum (T) (mg/l)	Iron (T) (mg/l)	Lead (T) (mg/l)	Manganese (T) (mg/l)	Selenium (T) (mg/l)	Zinc (T) (mg/l)
Water Quality Std. (mg/l)		6-5 - 8-5		10.00	0.05	500		250	0.20	1.00	Varies	0.050	0.020	Varies
Lower North Fork Gunnion (NFG-low)														
Number of Samples	10	10	6	5	5	6	6	8	6	8	6	6	6	6
Minimum	1.6	8.1	61	-0.02	-0.01	80	-5	-10	0.10	0.11	-0.02	0.014	-0.001	-0.010
Maximum	17.6	6.7	123	0.16	0.01	150	52	20	1.29	1.48	-0.05	0.031	-0.040	-0.030
Average	10.2	6.4	92	0.05	0.006	120	14	14	0.51	0.49	-0.02	0.020	-0.004	0.017
Standard Deviation	5.9	0.2	26	0.06	0.002	32	19	7	0.53	0.52	0.01	0.006	0.006	0.010
Terror Cree below Confluence W. Terror (TC-up)														
Number of Samples	10	10	6	5	5	6	6	6	6	6	8	8	6	6
Minimum	0.6	6.1	66	-0.02	-0.01	100	-5	-10	0.20	0.28	-0.02	0.018	-0.001	-0.010
Maximum	19.2	6.8	103	0.04	0.01	150	52	20	3.70	2.81	-0.04	0.140	-0.040	0.040
Average	8.66.4	8.4	88	0.02	0.006	122	16	6	1.10	0.92	-0.02	0.047	-0.004	0.017
Standard Deviation	6.70.1	0.1	18	0.01	0.002	17	20	8	1.33	0.89	0.01	0.048	0.006	0.013
North Fork of Gunnison (NF-1)														
Number of Samples	53	52	36			43	43	19	19	43	42	(1) 41	19	41[1]
Minimum	0.0	7.2	35			4	1	5	-0.02	0.03	-0.01	-0.01	-0.001	-0.005
Maximum	24.3	9.5	140			208	250	21	5.83	6.28	0.08	0.183	0.038	0.090
Average	9.6	6.5	84			102	38	11	1.12	0.84	0.02	0.040	0.004	0.012
Standard Deviation	5.6	0.5	32			43	80	4	1.87	1.27	0.01	0.04	0.008	0.006
North Fork of Gunnison (NF-2)														
Number of Samples	52	52	38			41	42	19	19	42	37	37	19	41
Minimum	0.0	6.9	22			30	1	4	-0.02	0.03	-0.01	-0.01	-0.001	-0.005
Maximum	24.0	9.5	200			398	170	21	4.12	5.71	1.00	0.140	0.014	0.092
Average	9.5	6.5	93			132	29	11	0.89	0.88	0.04	0.032	0.004	0.012
Standard Deviation	5.7	0.5	49			76	38	4	0.98	0.98	0.16	0.031	0.003	0.018

Table 3.5-2
Selected Surface Water Quality Summary

	Temperature (°C)	Field pH	Bicarbonate (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	TDS (mg/l)	TSS (mg/l)	Sulfate (mg/l)	Aluminum (T) (mg/l)	Iron (T) (mg/l)	Lead (T) (mg/l)	Manganese (T) (mg/l)	Selenium (T) (mg/l)	Zinc (T) (mg/l)
Water Quality Std. (mg/l)		6-5 - 8-5		10.00	0.05	500		250	0.20	1.00	Varies	0.050	0.020	Varies
North Fork Gunnison (NF-3)														
Number of Samples	6	6	6			6	6	6	6	6	6	6	6	6
Minimum	2.0	7.2	49			46	6	4	-0.02	0.050	-0.01	0.013	-0.001	-0.005
Maximum	23.0	8.6	150			172	50	25	0.46	0.45	0.025	1.109	0.007	0.025
Average	12.3	8.0	100			116	17	12	0.19	0.26	0.022	0.034	0.004	0.006
Standard Deviation	9.0	0.6	35			48	17	7	0.16	0.13	0.008	0.038	0.002	0.009

Reference for Standards: EPA. Primary Drinking Water Standards, Colorado Department of Health, North Fork Gunnison River
Period of Record for each station corresponds to Table 3.5-1, Surface Water Monitoring Summary
"–" Denotes less than detection limit
Average and standard deviation calculated by assuming concentrations less than detection limit equal to ½ of the detection limit.
(1) Concentration of "zero: In database was omitted in statistical calculations.

of the Gunnison River. NFG-up is located immediately upstream of the confluence of Hubbard Creek with the North Fork of the Gunnison River and NFG-low is located approximately 1,500 feet downstream of the confluence of Terror Creek with the North Fork of the Gunnison River.

The monitoring stations on the North Fork of the Gunnison monitored by Oxbow are designated NF-1, located upstream of the Sanborn Creek Mine facilities area, and NF-2, located at the Sanborn Creek Mine facilities area. There is a station on the North Fork of the Gunnison River located downstream; however, the period of record is much shorter than NF-1 and NF-2. Water quality is good with low concentrations of TDS, nitrate, nitrite and metals. There have been occasional exceedances of total iron and manganese. However, the average concentrations are below the state standard for both of these parameters.

Elk Creek Coal Lease Tract - Baseline water quality for Elk and Bear creeks is limited to TDS, TSS, alkalinity, total and dissolved iron, and total manganese for a period of record from May 1980 to April 1982. Concentrations of TDS and total suspended solids (TSS) are very high (averaging 2,300 mg/l and 75 mg/l, respectively) in Lower Bear Creek (B-1) at the confluence with the North Fork of the Gunnison River. During the early 1980s, several landslides may have impacted the water quality of Lower Bear Creek by increasing the sediment load of overland flow to Bear Creek (R. Dunrud, 1999, personal communication). Upper Bear Creek (B-2) had concentrations of TDS and TSS averaging 247 mg/l and 31.35 mg/l, respectively.

A portion of Elk Creek was diverted through a section of culvert in the early 1980s. The effects of this construction are seen in the concentrations of TDS and TSS during this time. Concentrations of TDS are high in both stations on Elk Creek (averaging 439 mg/l at E-2 and 434 mg/l at E-1). Average concentrations of total iron and total manganese also exceed the state standards during this period of record.

3.5.2.4 Seasonal Trends in Surface Water Quality

General seasonal trends in surface water quality were not obvious in reviewing the Bowie or Oxbow water quality data. The relatively short period of record likely explains the lack of significant trends. The water quality data for Oxbow reflects an earlier period of record that is also relatively short.

3.5.2.5 Water Users/Water Rights

The study area is located within the Colorado Division of Water Resources Division 4, District 40. Water rights for this district were obtained from this agency, and these are shown on *Figure 18, Water Rights*. *Table 3.5.3, Water Rights Summary for Wells, Springs, and Surface Water*, gives additional information about water rights located on *Figure 18, Water Rights*. The map and table include all water rights in an area bounded by a 1 mile buffer around the Iron Point Exploration License area and the Iron Point and Elk Creek Coal Lease tracts. Water rights originating from the North Fork of the Gunnison River between the Sanborn Creek surface facilities area and the Bowie No. 2 Mine surface facilities are also included, even though they may be located more than 1 mile from the lease area boundaries. Water rights originating from Hubbard Creek or west of Hubbard Creek are considered in the Iron Point Coal Lease Tract and the Iron Point exploration license area, and those east of Hubbard Creek are considered in the Elk Creek Coal Lease Tract area.

Iron Point Coal Lease Tract and Exploration License Area - There are nine ten ditches originating from Hubbard Creek and its tributaries that are located within the boundaries described above. Four of these ditch headgates, the Wade Allen Ditch, the Carl Galphin Ditch, the Pilot Knob Ditch, and the Carter Ditch, are located north of the exploration license area, but

Table 3.5-3
Water Rights Summary for Wells, Springs, and Surface Water

WATER RIGHT NAME	Map #	TS	RNG	SEC	Q160	Q40	Q10	ADJ DATE	APRO DATE	USE TYPE *	RATE ABS	VOL ABS	RATE COND	VOL COND
BLUE RIBBON DITCH NO 1	2	13 S	91 W	2	NW	NW	NE	12/31/77	1/24/77	DOMIND	2			
BLUE RIBBON RES NO 1	2	13 S	91 W	2	NW	NW	SE	12/31/77	1/24/77	DOMIND	0	10.2		
BLUE RIBBON WELL	2	13 S	91 W	2	NW	NW	NE	12/31/77	1/24/77	DOMIND	0.033			
J & M SPRING & PL NO 2	3	13 S	91 W	3	NW	SW	SW	12/31/70	7/1/34	DOMSTK	0.004			
J & M SPRING & PL NO 1	4	13 S	91 W	4	NE	NE	SW	12/31/70	7/1/34	DOMSTK	0.009			
DEERTRAIL DITCH	11	13 S	91 W	11	NE	SW	NW	4/12/01	1890-11-01	IRR	1.25			
DEERTRAIL DITCH	11	13 S	91 W	11	NE	SW	NW	4/12/01	1893-06-01	IRR	0.322			
DEERTRAIL DITCH	11	13 S	91 W	11	NE	SW	NW	4/12/01	1893-06-06	IRR	0.344			
DEERTRAIL DITCH	11	13 S	91 W	11	NE	SW	NW	6/23/14	1893-07-01	IRR	1.594			
DEERTRAIL DITCH	11	13 S	91 W	11	NE	SW	NW	3/20/54	1890-11-05	DOMIRR	1.044			
DEERTRAIL DITCH	11	13 S	91 W	11	NE	SW	NW	3/20/54	2/15/07	INDIRR	0.294			
MAJNIK DITCH	14	13 S	91 W	14	NE	NW	NE	5/28/37	4/1/01	IRR	1.5			
MAYES DITCH	14	13 S	91 W	14	NE	NE	NE	6/23/14	6/1/02	IRR	0.375			
TERROR CREEK														
GRAND MESA CANAL HGT 3	29	12 S	91 W	29	SE	NE	SW	1/31/64	6/15/61	IRR			25	
GARVIN MESA PIPELINE CO	32	12 S	91 W	32	SW	NE	NW	12/31/76	9/25/76	DOM	0.04			
HUGHES PIPELINE	32	12 S	91 W	32	SW	SW	SE	12/31/77	1/7/77	DOM				
J & M SPRING & PL NO 3	4	13 S	91 W	4	NW	SW	SE	12/31/70	7/1/34	DOMSTK	0.009			
J & M SPRING & PL NO 4	4	13 S	91 W	4	NE	SW	NW	12/31/70	7/1/34	DOMSTK	0.011			
J & M SPRING & PL NO 5	4	13 S	91 W	4	NW	SE	NW	12/31/70	7/1/34	DOMSTK	0.011			
BARROW SPRING PIPELINE	5	13 S	91 W	5	NW	SW	SW	12/31/74	6/1/24	DOMRECSTK	0.1			
LEONARD SPRING NO 1	7	13 S	91 W	7	NE	SE	NE	12/31/74	6/1/20	DOMRECSTK	0.05			
LEONARD SPRING NO 2	7	13 S	91 W	7	NE	SE	NE	12/31/74	6/1/20	DOMRECSTK	0.05			
TERROR DITCH	17	13 S	91 W	17	NE	NE	SE	1889-06-17	1883-11-13	IRR	0			
TERROR DITCH	17	13 S	91 W	17	NE	NE	SE	4/12/01	1884-12-11	IRR	6			
TERROR DITCH	17	13 S	91 W	17	NE	NE	SE	2/10/30	5/1/01	IRR	6			
TERROR DITCH	17	13 S	91 W	17	NE	NE	SE	3/20/54	1884-12-11	DOM	1.5			
FAWCETT DITCH	21	13 S	91 W	21	SW	NE	SW	1889-06-17	1883-11-13	IRR	0.115			
FAWCETT DITCH	21	13 S	91 W	21	SW	NE	NW	3/20/54	4/15/44	IRRDOM	1.25			
HOLYBEE DITCH	21	13 S	91 W	21	NW	SW	SE	1889-06-17	1883-11-13	IRR	0.4			
FIRE MT CANAL	21	13 S	91 W	21	SW	NW	NE	2/10/30	7/1/03	IRR	70			
PUPIK POND	21	13 S	91 W	21	SW	NW	NE	12/31/80	6/23/80	DOMIRRSTK	0	2		
CLOUDS WELL	21	13 S	91 W	21	SE	SW	NW	12/31/75	10/4/73	DOM	0.003			

Type Key: IRR – Irrigation, DOM – Domestic, STK – Stock Watering, REC – Recreation, IND – Industrial, OTH – Other, COM – Commercial, WLD – Wildlife

Table 3.5-3
Water Rights Summary for Wells, Springs, and Surface Water

WATER RIGHT NAME	Map #	TS	RNG	SEC	Q160	Q40	Q10	ADJ DATE	APRO DATE	USE TYPE *	RATE ABS	VOL ABS	RATE COND	VOL COND
N. FORK GUNNISON RIVER														
FIRE MT CANAL		0	0					3/20/54	6/1/35	IRR				
FIRE MT CANAL	23	13 S	90 W	8	SW	SW	SW	2/10/30	6/24/14	IRR	7.5			
FIRE MT CANAL	23	13 S	90 W	8	SW	SW	SW	3/20/54	1896-09-14	DOM	30			
FIRE MT CANAL	23	13 S	90 W	8	SW	SW	SW	3/20/54	6/1/35	IRROTH	106			
SOMERSET MINE WELL	24	13 S	90 W	8	SE	SW		12/31/79	6/8/78	IND	0.44			
BEAR WELL NO 1	25	13 S	90 W	8	SE	SE		12/31/93	7/15/82	COMDOM	0.222			
FIRE MT CANAL	23	13 S	90 W	17	NW	NW	SW	2/20/04	1896-09-14	IRR	50			
FIRE MT CANAL	23	13 S	90 W	17	NW	NW	SW	8/23/14	8/1/09	IRR	44.5			
FIRE MT CANAL	23	13 S	90 W	17	NW	NW	SW	2/10/30	7/1/09	IRR	0			
CARROL DITCH	26	13 S	90 W	18				2/20/04	1888-02-28	IRR	0.825			
NEW MAJNIK HOUSE WELL	27	13 S	91 W	14	NE	SE	SE	12/31/75	8/5/72	DOMSTK	0.033			
SELL NO 1 WELL	28	13 S	91 W	14	NE	SE	SE	12/31/72	5/1/20	DOMSTK	0.033			
JENKINS DITCH NO 1	29	13 S	91 W	15	SW	SW	SE	8/11/69	6/1/24	IRR	0.25			
JENKINS DITCH NO 1	29	13 S	91 W	15	SW	SW	SE	8/11/69	6/1/64	IRR	0.5			
JENKINS DITCH NO 2	30	13 S	91 W	15	SW	SE	NW	8/11/89	8/1/24	IRR	0.25			
JENKINS DITCH NO 2	30	13 S	91 W	15	SW	SE	NW	8/11/69	6/1/64	IRR	0.5			
STEWART DITCH	31	13 S	91 W	15	SW	SE	SE	12/31/94	12/31/20	STK	5			
BRONISH NO1 WELL	32	13 S	91 W	15	SE	NW	SE	12/31/72	5/1/40	DOMIRR	0.067			
STEPHENS DITCH	33	13 S	91 W	16	SE	SE	SE	3/20/54	5/10/08	DOM	0.25			
STEWART DITCH	33	13 S	91 W	21	NW			4/12/01	1882-06-01	IRR	1.25			
STEWART DITCH	33	13 S	91 W	21	NW			4/12/01	1892-12-27	IRR	4.73			
STEWART DITCH	33	13 S	91 W	21	NW			2/20/04	1895-11-30	IRR	50.75			
STEWART DITCH	33	13 S	91 W	21	NW			2/20/04	4/1/01	IRR	1.06			
STEWART DITCH	33	13 S	91 W	21	NW			2/10/30	12/13/10	IRR	19.25			
TOLTEC SPRING	34	13 S	91 W	21	SE	NW	NW	12/31/92	7/7/82	IRROTHSTKW LDDOM	0.06		0.03	
TRAIN LOADOUT WELL NO 1	35	13 S	91 W	29	SE	NW	NE	12/31/80	12/31/79	DOMIND	0.11		0.002	
BEAR CREEK														
BURTARD DITCH	36	12 S	90 W	30	NW	SW	NW	3/20/54	6/1/29	IRR	2.5			
HUBBARD CREEK														
WADE ALLEN DITCH	37	12 S	91 W	10	SE	NW	NE	5/28/37	8/1/04	IRR	3.5			
WADE ALLEN DITCH	37	12 S	91 W	10	SE	NW	NE	3/20/54	6/5/48	IRR	3.5			
CARL GALPIN DITCH	38	12 S	91 W	12	SW	SE	NW	1/31/64	1/1/56	IRR	3			
PILOT KNOB DITCH	39	12 S	91 W	12	SW	SW	SE	2/10/30	6/13/11	IRR	1			
HUBBARD CREEK	40	12 S	91 W	14	SE	NW	NW	12/31/84	5/4/84	MIN	3			
CARTER DITCH	24	12 S	91 W	24	NE	NW	SE	5/28/37	10/1/22	IRR	2.12			
BRUCE PARK RESERVOIR	28	12 S	91 W	28	SW	SE	SE	5/28/37	9/13/13	IRR	0	550.5		
BRUCE PARK RESERVOIR	28	12 S	91 W	28	SW	SE	SE	3/20/54	5/9/50	IRR	0	81.5		

within 1 mile of the boundary. The Wade Allen Ditch headgate is located on Hubbard Creek. The Carl Galpin Ditch headgate is located on Pilot Creek, tributary to Hubbard Creek. The Pilot Knob Ditch headgate is located just south of the Galpin Ditch headgate. The Carter Ditch headgate is located on Cottonwood Creek.

The Terror Ditch Extension headgate is located on West Hubbard Creek approximately 4 miles northwest of Terror Creek Reservoir. This water right is listed in *Table 3.5-3, Water Rights Summary for Wells, Springs and Surface Water*, but is located too far north to be shown on *Figure 18, Water Rights.*

The Hubbard Creek Ditch headgate is located at the northern boundary of the exploration license area boundary on Hubbard Creek. The Blue Ribbon Ditch headgate is located on private land and is adjacent to the historic Blue Ribbon Mine on Hubbard Creek.

The Deertrail Ditch headgate is located on Hubbard Creek south and between the Elk Creek and Iron Point Coal Lease tracts. The Majnik and Mayes Ditches are located south of the Deertrail Ditch.

There are two reservoirs within the Hubbard Creek drainage basin. The Terror Creek Reservoir (known as the Bruce Park Reservoir in the water rights listing) is located in the northwestern corner of the exploration license area. The reservoir straddles the Hubbard and Terror creek drainage basins with a dam in each basin. The water source is Hubbard Creek; however, water from the reservoir can be released to either Hubbard or Terror creeks. The Blue Ribbon Reservoir No. 1 feeds the Blue Ribbon Ditch mentioned above. See *Figure 18, Water Rights.*

There are seven ditches, or canals, originating in the Terror Creek drainage basin. One canal, the Grand Mesa Canal No. 3, has a headgate located on the East Fork Terror Creek. It is located in the northwestern corner of the exploration license area, northwest of the Terror Creek Reservoir. The Garvin Mesa Pipeline and the Hughes Pipieline are located immediately west of the exploration license area on an unnamed tributary to East Fork Terror Creek.

The remaining four ditches have headgate locations south of the Iron Point Coal Lease Tract on Terror Creek. The Terror Ditch headgate is located approximately 0.6 miles south of the southernmost boundary of the Iron Point Coal Lease Tract. The Fire Mountain Canal (additional headgate), Fawcett Ditch, and the Holybee Ditch have headgates located near the confluence of Terror Creek with the North Fork of the Gunnison River. These ditches are all located more than 1 mile south of the Iron Point Coal Lease Tract area, but they were included because the water source could be impacted upstream by the proposed mining.

Seven ditches originating in the North Fork of the Gunnison River were also included because of the potential that the water source could be impacted upstream by mining. They are the Fire Mountain Canal, the Carrol Ditch, the Jenkins Ditches No. 1 and 2, the Stewart Ditch, the Stephens Ditch, and an additional headgate for the Stewart Ditch.

Elk Creek Coal Lease Tract - There is one surface water right listed in the Bear Creek drainage basin. The Burtard Ditch headgate is located on Bear Creek, approximately 0.6 miles north of the Elk Creek Coal Lease Tract. There are no surface water rights in the Elk Creek drainage.

3.5.2.6 Influence of Past Mining on Surface Water

Various National Pollution Discharge and Elimination System (NPDES) permits granted to the current mine operators regulate impacts of current and historical mining on local streams.

Monitoring on the North Fork of the Gunnison River shows little impact to the water quality from current or historical mining. Occasional increased concentrations of metals have been observed during periods of increased runoff during the spring. The high sulfate concentrations found in the B and C gulches also do not appear to impact the water quality of the North Fork of the Gunnison River.

Subsidence impacts from past mining have been observed in several areas. *Appendix K, Subsidence Evaluation*, describes a subsidence area near Bear Creek undermined by room-and-pillar mining techniques. Overburden in this area is less than 500 feet thick. Although subsidence was observed in the form of cracks in the weathered bedrock and colluvium from 15 to 100 feet above the stream channel, there were no cracks observed in saturated alluvium underlying the stream. There was also no evidence of loss of flow observed downstream in Bear Creek. The soils and alluvium in the near-surface zone typically behave as a yieldable type of material; that is, they have the ability to yield or stretch without rupturing or breaking.

3.5.3 Environmental Consequences

Potential environmental consequences of leasing (and eventual mining of) the Iron Point and Elk Creek Coal Lease Tract and granting the Iron Point Exploration License include the following impacts:

- Dewatering of the D coal seam could disrupt flow on some sections of Hubbard Creek, which are fed from the D seam;
- Water discharge from the mines to surface streams could impact the quality of water in the receiving streams; and,
- Increased construction and use of surface facilities could increase sedimentation.

In addition, subsidence caused by longwall mining can potentially disrupt stream flow and ponds directly above the underground mine and within the angle of draw. Other mine subsidence impacts could include changes in drainage channel morphology resulting in changes in general surface gradients, which could lead to head cutting, pooling, soil erosion, and sedimentation.

Figure 14, Subsidence Potential Map, describes the subsidence impacts within potential zones ranging from "very low to low" potential for subsidence, to "high to very high" potential. *Table 3.5-4, Water Rights Impact Summary*, specifically addresses the impact to headgate locations for water rights listed in *Table 3.5-4, Water Rights Impact Summary.*

3.5.3.1 Effects of Alternative A (No-Action)

The No-Action Alternative would preclude impacts from the Iron Point and Elk Creek Coal Lease tracts and the Iron Point Exploration License area, as exploration activities and mine development would not occur. There would be no surface water impacts from the lease tracts and exploration license area.

Existing impacts to surface water quality from current and past mining, as well as other current land uses, would continue. Bowie would continue mining the D seam from their fee (private) reserves. Treatment of water discharged from the existing mines would continue to be regulated by the Colorado Department of Public Health and Environment through NPDES permits. Water use from the existing operation of the Bowie No. 2 mine varies seasonally and would be met with a variety of water rights, including 0.5 cfs from the Deertrail Ditch.

Table 3.5-4
Water Rights Impact Summary

Water Right Name	Map #	Location						Overburden Thickness			
		TS	RNG	SEC	Q160	Q40	Q10		Alt. B	Alt. C	Alt. D
Bear Creek											
Burtard Ditch	36	12S	90W	30	NW	SW	NW	2400	--	--	--
Hubbard Creek											
Terror Ditch Extension	NA	12S	91W	6	SE	SW	SE	2500+	--	--	--
Wade Allen Ditch	37	12S	91W	10	SE	NW	NE	2500+	--	--	--
Carl Galpin Ditch	38	12S	91W	12	SW	SE	NW	2500+	--	--	--
Pilot Knob Ditch	39	12S	91W	12	SW	SW	SE	2500+	--	--	--
Hubbard Creek	40	12S	91W	14	SE	NW	NW	2500+	--	--	--
Carter Ditch	1	12S	91W	24	NE	NW	SE	2475	--	--	--
Bruce Park Reservoir	2	12S	91W	28	SW	SE	SE	2125	Low	Low	Low
Blue Ribbon Ditch No. 1	3	13S	91W	2	NW	W	NE	50	Very High	Very High	High[1]
Blue Ribbon Reservoir No. 1	4	13S	91W	2	NW	NW	SE	(1)-	Very High	Very High	High[1]
Blue Ribbon Well	5	13S	91W	2	NW	NW	NE	50	Very High	Very High	High[1]
J&M Spring & PL No. 2	6	13S	91W	3	NW	SW	SW	1175	Moderate	Moderate	Moderate
J&M Spring & PL No. 1	7	13S	91W	4	NE	NE	SW	1325	Moderate	Moderate	Moderate
Deertrail Ditch	8	13S	91W	11	NE	SW	NW	--	Very High	Very High	High[1]
Majnik Ditch	9	13S	91W	14	NE	NW	NE	--	Very High	Very High	High[1]
Mayes Ditch	10	13S	91W	14	NE	NE	NE	--	Very High	Very High	High[1]
Terror Creek											
Grand Mesa Canal HGT 3	11	12S	91W	29	SE	NE	SW	2125	Low	Low	Low

Table 3.5-4
Water Rights Impact Summary

Water Right Name	Map #	Location						Overburden Thickness			
		TS	RNG	SEC	Q160	Q40	Q10		Alt. B	Alt. C	Alt. D
Terror Creek (continued)											
Garvin Mesa Pipeline Co.	12	12S	91W	32	SW	NE	NW	1425	Low	Low	Low
Hughes Pipeline	13	12S	91W	32	SW	SW	SE	1000	Low	Low	Low
J&M Spring & PL No. 3	14	13S	91W	4	NW	SW	SE	850	High	High	High
J&M Spring & PL No. 4	15	13S	91W	4	NE	SW	NW	1375	Low	Low	Low
J&M Spring & PL No. 5	16	13S	91W	4	NW	SE	NW	1025	Moderate	Moderate	Moderate
Barrow Spring Pipeline	17	13S	91W	5	NW	SW	SW	700	Low	High	Low
Leonard Spring No. 1	18	13S	91W	7	NE	SE	NE	1075	--	--	--
Leonard Spring No. 2	19	13S	91W	7	NE	SE	NE	1075	--	--	--
Terror Ditch	20	13S	91W	17	NE	NE	SE	--	Very High	Very High	Low
Fawcett Ditch	21	13S	91W	21	SW	NE	SW	--	--	--	--
Fawcett Ditch	21	13S	91W	21	SW	NE	NW	--	--	--	--
Holybee Ditch	22	13S	91W	21	NW	SW	SE	--	--	--	--
Fire Mountain Canal	23	13S	91W	21	SW	N	NE	--	--	--	--
Pupik Pond	24	13S	91W	21	SW	NW	NE	--	--	--	--
Clouds Well	25	13S	91W	21	SE	SW	NW	--	--	--	--
North Fork of the Gunnison River											
Fire Mountain Canal	23	13S	90W	8	SW	SW	SW	--	--	--	--
Somerset Mine Well	24	13S	90W	8	SE	SW		--	--	--	--
Bear Well No. 1	25	13S	90W	8	SE	SE		--	--	--	--

Table 3.5-4
Water Rights Impact Summary

Water Right Name	Map #	Location						Overburden Thickness			
		TS	RNG	SEC	Q160	Q40	Q10		Alt. B	Alt. C	Alt. D
North Fork of the Gunnison River (continued)											
Fire Mountain Canal	23	13S	90W	17	NW	NW	SW	--	--	--	--
Carrol Ditch	26	13S	90W	18	NW			--	--	--	--
New Majnik House Well	27	13S	91W	14	NE	SE	SE	--	--	--	--
Sell No. 1 Well	28	13S	91W	14	NE	SE	SE	--	--	--	--
Jenkins Ditch No. 1	29	13S	91W	15	SW	SW	SE	--	--	--	--
Jenkins Ditch No. 2	30	13S	91W	15	SW	SE	NW	--	--	--	--
Stewart Ditch	31	13S	91W	15	SW	SE	SE	--	--	--	--
Bronish No. 1 Well	32	13S	91W	15	SE	NW	SE	--	--	--	--
Stephens Ditch	33	13S	91W	16	SE	SE	SE	--	--	--	--
Stephens Ditch	33	13S	91W	21	NW			--	--	--	--
Stephens Ditch	33	13S	91W	21	NW			--	--	--	--
Stephens Ditch	33	13S	91W	21	NW			--	--	--	--
Toltec Spring	34	13S	91W	21	SE	NW	NW	--	--	--	--
Train Loadout Well No. 1	35	13S	91W	29	SE	NW	NE	--	--	--	--

-- Located outside the impact area shown on Figure 14, Subsidence Potential Map. No impact expected.
1. Alternative D reduces the impact to this water right to a designation of "high." The risk of impact remains "high" for water rights located downstream of the D seam coal outcrop due to the effect of dewatering the D seam during mining. See Section 3.5.3.3, Effects Common to All Action Alternatives, Iron Point Exploration License Area and Coal Lease Tract.

Oxbow would finish longwall mining in the Sanborn Creek Mine and develop and mine fee (private) reserves from the planned Elk Creek Mine. Dewatering operations in these mines would continue, and mine discharge would continue to be treated and released to the North Fork of the Gunnison River under provisions of an existing NPDES permit.

3.5.3.2 Effects Common to All Action Alternatives

Direct Effects - For all alternatives, coal would be mined by longwall techniques. The direct effects of this mining on surface water resources is discussed in this subsection.

In considering Alternatives B, C, and D, the Iron Point Exploration License would be approved, and the Iron Point Coal Lease Tract would be offered for leasing. Access road and drilling pad construction that would be required by the exploration drilling program could cause minor impacts to surface water resources due to sedimentation. There would be no negative impact to the quantity of flow in area streams from the exploration activities. Provided that the exploration firm(s) would obtain water under existing rights, which is required by the Colorado Division of Water Resources, there would be no impacts to water users or water rights. Water usage for exploration would be relatively minor (5 to 6 acre-feet/year). Such usage would be only during drilling activities that would be conducted for 2 years under an exploration license. In addition, such drilling would be seasonal, conducted during the dry (late spring, summer, autumn) months of the year.

The companies successful in leasing the Iron Point Tract would develop mine plans complying with applicable federal and state rules and regulations, including stipulations of the coal leases.

Dewatering of the D coal seam could decrease flow in the vicinity of Hubbard Creek near, and upstream of the historic (now abandoned) Blue Ribbon Mine. Hubbard Creek in this area (T13S, R91W, Section 34) receives contribution from groundwater originating in the D seam. The D seam is saturated as it outcrops in the Hubbard Creek drainage. Flow from the D seam contributes to the perennial flow in Hubbard Creek. Surface water flow loss would be temporary during mining, the D seam would be dewatered to allow for efficient and safe operations. Following mining, dewatering activities would be terminated and groundwater levels should return to their approximate pre-mining condition. See Section 3.6, Groundwater, for additional discussion.

Water discharge from the mines to surface streams could impact the quality of water in the receiving streams. Mine effluent would be regulated, and any discharge to receiving streams would have to meet permitted effluent requirements. Concentrations of TDS, iron, manganese, and sulfate could be constituents likely to increase.

Subsidence resulting from longwall mining can potentially disrupt stream flow and ponds directly above the underground mine ~~and~~ within the angle of draw. Any temporary stream flow loss could affect the amount of water available for surface water diversion to water users downstream. Water rights diverted from Hubbard Creek and Terror Creek could be impacted. A water replacement plan would be required to address negative impacts to water rights, as discussed in Section 3.5.5, Potential Surface Water Hydrology Mitigation and Monitoring.

Within the Iron Point Coal Lease Tract, segments of Hubbard and Terror Creeks, as well as most of the Freeman Gulch channel, the lower segments of Sheep Corral Gulch, and Dove Gulch, flow through areas that have a "high to very high" subsidence potential. See *Figure 14, Subsidence Potential Map.* Impacts from subsidence to these drainages could include changes in drainage channel morphology resulting in changes to general surface gradients. In turn, these impacts could cause cutting, pooling, soil erosion, and sedimentation.

Terror Creek Reservoir lies within the “very low to low” potential category. Therefore, no direct effects to the Terror Creek Reservoir are expected as a result of subsidence; a 25 degree angle of draw has been left between the northern boundary of the Iron Point Coal Lease Tract and the southern tip of the reservoir. See Section 8.4.1, Options in Regard to Mining in the Area of the Terror Creek Reservoir, in *Appendix K, Subsidence Evaluation*. The Iron Point Coal Lease Tract boundary and the projected angle of draw do not extend to Terror Creek Reservoir. See *Figure 14, Subsidence Potential Map*.

Bear Creek and Elk Creek, which are intermittent drainages, do not receive contributions to surface water flow from the D seam, because the D seam does not outcrop in these drainages. Rather it dips to the northeast. See *Figure 14, Hydrogeologic Cross-Section A-A'*. Dewatering of the D seam in Elk Creek Tract is not expected to decrease surface water flow. However, longwall mining in the Elk Creek Tract would likely require dewatering of the saturated D seam.

Mine water would be stored in sumps. It would be discharged, or treated and discharged, to the North Fork of the Gunnison River. This would be a discharge of groundwater during mining operations. This discharge would not be tributary to the North Fork of the Gunnison River since the groundwater gradient is to the northeast.

Oxbow is presently dewatering the B seam as part of its ongoing operations at the Sanborn Creek Mine under provisions of an existing NPDES permit. A similar arrangement would be expected for the D seam mining in the Elk Creek Coal Lease Tract.

A segment of Bear Creek lies within the “moderate to high” subsidence zone. The remainder of the Upper Bear Creek drainage lies within the “low to moderate” subsidence zone. See *Figure 14, Subsidence Potential Map*.

The Elk Creek stream channel falls outside of the Elk Creek Coal Lease Tract boundary. However, a portion of Elk Creek in T12S, R90W, Section 32, lies within the angle of draw for mining in a “very low to low” subsidence zone. See *Figure 14, Subsidence Potential Map*.

Two small unnamed ephemeral drainages tributary to Hubbard Creek originate in the southwestern-most corner of the Elk Creek Coal Lease Tract and fall within the “high to very high” and “moderate to high” subsidence zones.

There is a potential for mine subsidence to cause changes in channel morphology including minor head cutting, pooling, channel adjustment, etc. Surface tension cracks also have the potential to develop within and surrounding the drainages. These changes could cause increased soil erosion and sedimentation.

Given the intermittent and ephemeral nature of the drainages within the Elk Creek Coal Lease Tract, as well as their existing steep gradients, the thickness of overburden, and the natural geologic instability of the area, subsidence would have minimal impact to these drainages.

There is one surface water right located near the Elk Creek Coal Lease Tract. The Burtard Ditch is located north of the tract boundary and outside the angle of draw. Impacts to this water right are not expected.

Indirect Effects - No indirect effects on surface water are expected as a result of exploration activities or of mining within the Elk Creek Coal Lease Tract.

If leased, subsequent mining within the Iron Point Tract could lead to indirect effects on the Terror Creek Reservoir. These include potential impacts to the structural integrity of the

impoundment due to mining induced seismicity. Available information suggests that there is greater risk from seismic activity generated from collapse of historic room-and-pillar mines in the Somerset area, than from proposed longwall operations. However, it is expected that subsidence associated with longwall mining could also generale seismic activity (see *Appendix K, Subsidence Evaluation*). Further definition of potential indirect impacts to Terror Creek Reservoir could be made with additional monitoring and evaluation of impoundment construction and integrity, along with local geologic conditions.

3.5.3.3 Effects of Alternative B

Under Alternative B, it is assumed that longwall mining would be conducted under the perennial portions of Hubbard Creek and Terror Creek in the Iron Point Coal Lease Tract. Subsidence associated with longwall mining produces different effects than subsidence caused by room-and-pillar mining. As such, several investigations regarding the impact of longwall subsidence to perennial drainages in western coalfields were consulted.

One study in a Utah coalfield showed that subsidence fractures up to 7 feet wide formed in a stream channel where 300 to 500 feet of overburden was present (USGS, 1995). Water from the creek was intercepted and reportedly reached the mine level. Other effects included a change in the type of water present and a variation in the gain-loss characteristics of the drainage.

A second study in Utah was performed on a creek where 600 feet of overburden was present. In this case, there were no discernible impacts to stream flow, although minor channel adjustments were observed. The lack of observed impacts were attributed to the presence of a thick, well-developed alluvial system (about 15 feet thick) that served to buffer the impacts (Mattson, L.L and J.A. Magers, 1995, and USDA-FS, 1999).

At one Colorado mine, a drainage with perennial flow was subsided where about 1,100 feet of overburden was present. The drainage flowed across a portion of exposed sandstone bedrock in which a series of tension fractures formed. The fractures intercepted flow in the drainage for a short period. It was reported that the presence of a 600-foot thick shale unit between the mine level and the creek likely served to reduce the extent of impacts (R. Mills, 1999).

Based on the available case study results, the key to assessing the risk to a perennial drainage is considering the amount of overburden separating the land surface and the coal seam. The shallow overburden (i.e., less than 500 feet, see *Figure 13, D Seam Overburden Isopach*) present between Terror Creek, Hubbard Creek and lower Dove Gulch and the coal seams, place the drainages in a higher risk category to be directly affected by subsidence (see *Figure 14, Subsidence Potential Map*). Another factor is the presence of sufficient alluvial fill to buffer the effects. There is variable alluvial development present in the Terror and Hubbard Creek drainages. The risk to the drainages is hinged on the increased potential for cracks to form at the surface that could be contiguous with the mine level. If this cracking were to form in a stream channel, surface flows could be intercepted. If this were to occur, there would be translated effects to other resources, including potential loss of associated riparian vegetation, reduced habitat available for riparian obligate species, and loss of habitat for aquatic biota. The time it would take for fracture of this nature to "heal" is unknown. Therefore the duration of potential loss cannot be calculated.

Guidance from the Society of Mining Engineers (1992) recommends maintaining "60 times the mining height" separation between mine workings and surface water bodies for subsidence protection. Given the estimated extraction height of 10 feet in the lease areas (see *Appendix K, Subsidence Evaluation*), this would equate to about 600 feet.

3.5.3.4 Effects of Alternative C

Effects of Alternative C would be the same as Alternative B except that extending the western boundary of the Elk Creek Tract to the Iron Point Tract boundary would add an area that drains to Hubbard Creek, and is located in the “high to very high” and “moderate to high” subsidence zones. Dewatering the D seam in this area could further impact Hubbard Creek. Impacts to water quality in the Elk Creek Coal Lease Tract would remain the same as Alternative B.

3.5.3.5 Effects of Alternative D

Special subsidence protection (i.e., barrier pillars, buffer zones, etc.) would be required for those areas under Terror Creek, Hubbard Creek, and the Curecanti-Rifle 230/345 kV electric transmission line. Therefore, the effects of longwall mining as described in Alternatives B and C would be less likely to occur.

Subsidence effects to smaller drainages, such as Dove Gulch, Sheep Corral Gulch and Iron Point Gulch, as described in Section 3.5.3.2, Effects Common to All Action Alternatives, would remain the same. All other impacts, including effects from dewatering, effects on water quality, and impacts to water rights, would remain the same as Alternative C.

3.5.4 Cumulative Effects

Activities contributing to cumulative effects can be separated into several categories: mining, construction development, agriculture, water use, recreation, and logging. These activities are described in Section 1.9, Adjacent Activities.

Current mining activity in the North Fork of the Gunnison River Valley includes the Bowie No.1 Coal Loadout, the Bowie No. 2 Mine, the Sanborn Creek Mine, the Terror Creek Coal Loadout, and the West Elk Coal Mine. The Bowie No. 1 Mine is permitted for mining, but is inactive. Cumulative effects to surface water from mining activities include minimal impacts to water quality on the North Fork of the Gunnison River, localized impacts to area streams from sedimentation, and water use via adjudicated water rights.

Construction development activity includes the upgrade of State Highway 133 and future housing development. Effects to surface water from these activities, and effects from railroad maintenance/improvements could also temporarily contribute to sedimentation in the North Fork of the Gunnison River.

Agriculture is an important and significant activity in the North Fork of the Gunnison Valley. Cumulative effects to surface water quality would be minimal in the North Fork of the Gunnison River Valley. Under state law, the mine operator/lessee would be required to replace any water right injured as a result of mining activities. In addition, a Forest Service stipulation (which would be added to the BLM lease form) requires restoration of stream channels/drainages to protect stream flow in the event of damage.

Minimal logging is anticipated in this area in the future. Completion of the Hubbard No. 2 timber sale and a few small partial cut spruce-fir units are anticipated in the future. Effects from logging could impact surface water quality and increase sedimentation. Based on experience in the area, impacts to surface water would not be expected on small timber sale areas such as these. Recreation is fairly limited in the area due to the lack of developed recreational facilities. Hunting is the primary recreational activity in this area, and impacts to streams from four-wheeling activity can result in increased sedimentation and damage to drainage channels.

The effect on surface water of increasing production to 6 million tons of coal per year on the elk Creek Coal Lease Tract would be minimal.

3.5.5 Potential Surface Water Hydrology Mitigation and Monitoring

Mitigation and monitoring measures for surface water are set forth in *Table 3.5.5, Potential Mitigation and Monitoring Measures for Surface Water.*

Table 3.5-5
Potential Mitigation and Monitoring Measures for Surface Water

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
SW-1[3]	Development of additional surface water baseline data	Conduct an inventory of all existing water resources adjacent to, originating on, or flowing over the lease tracts.	1	Mining Company
SW-2	Assessment of the affects of mining on surface water resources.	Establish a monitoring system to locate, measure, and quantify mining impacts.	1-2	Mining Company
SW-3	Affects to stream channel morphology and protect flows.	Apply appropriate reclamation and revegetation techniques and methodologies.	1	Mining Company Agencies
SW-4	Potential loss of water by existing users.	Prepare a detailed and workable water replacement plan.	1	Mining Company Colorado DMG
SW-5	Negative impacts to existing wetlands, floodplains, and riparian areas.	Prohibit surface occupancy of wetlands, floodplains, and riparian areas. Allow minor use of such areas in the form of stream crossings in special cases.	1	Forest Service BLM Corps of Engineers
SW-6	Negative impacts to Terror Creek Reservoir.	Develop a plan for assessing the existing integrity of Terror Creek Reservoir. Develop a follow-up plan for monitoring reservoir stability, such as requiring a ground motion (seismic) monitoring plan.	1-2	Colorado DMG Forest Service
SW-7	Degradation of water quality and quantity in Terror Creek, Hubbard Creek, and their tributaries.	Continue baseline monitoring of water quantity and quality on terror creek, Hubbard Creek, and their tributaries.	1	Colorado DMG
SW-8	Degradation of water quality and quantity in Hubbard Creek.	Install at least one additional water monitoring site on Hubbard Creek.	1-2	Mining Company
SW-9	Negative impacts to water quality and quantity in Bear and Elk creeks.	Begin monthly monitoring of flow and water quality at specific points along Bear and Elk Creeks.	1-2	Colorado DMG

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

SW-1 - Conduct an inventory of all existing water sources (including gain/loss analysis on both Terror and Hubbard creeks) adjacent to, originating on or flowing over the lease tracts which may be impacted by subsequent mining activities. The inventory should include: the water right holder, location, source, amount of decree, beneficial use, current and historical flow (including seasonal/annual variation), and the appropriation and adjudication dates.

SW-2 - Establish~~ing~~ a monitoring system to locate, measure, and quantify progressive and final effects of underground mining activities on surface water resources as required under the mine permit issued from Colorado DMG.

SW-3 - Restore stream channels and protect stream flow in the event of adverse affects from subsidence.

SW-4 - Water replacement is required under the Surface Mining Control and Reclamation Act (SMCRA) and the Colorado Surface Coal Mining Reclamation Act. A water replacement plan for any injury that may be due to mining must be in place prior to mining in a particular drainage. The water replacement plan will include all existing water sources, including those presently adjudicated and historically put to beneficial use. The water replacement plan for each respective drainage shall be developed after consultation with the affected water right users, and federal and state authorities, and will be approved by state authorities. The water replacement plan will require, upon injury, replacement of water of suitable quality and water right seniority to provide for all existing uses, and be delivered to existing points of diversion in a timely manner. The plan will demonstrate both a legal and physical ability for implementation. A source of replacement water may include, but is not limited to, the transfer of water rights, an augmentation plan, a long term water use lease, or compensatory storage, sustaining water resources to maintain properly functioning ecosystems.

SW-5 - No surface occupancy or use will be allowed in wetland areas, floodplains, or riparian areas. This stipulation would be a requirement of the lease and exploration license. Limited use in the form of stream crossings would be considered under special circumstances as necessary.

SW-6 - Prior to mining, a plan for assessing the existing integrity of Terror Creek Reservoir and a plan for monitoring the stability and ground motion (seismic) would be required.

SW-7 - Baseline monitoring for surface water quantity and quality on Terror Creek, Hubbard Creek, or their tributaries should be continued on the lease tracts and exploration license area as would be required under the mine permit. Due to the potential temporary loss of baseflow in sections of Hubbard Creek from dewatering of the D seam in the Iron Point Coal Lease Tract, it is recommended that stream flow and water quality monitoring be continued at the existing Hubbard Creek locations.

SW-8 - At least one additional surface water monitoring site should be installed on Hubbard Creek, either above or below the sandstone outcrop located below the historic (now abandoned) Blue Ribbon Mine. Monthly instantaneous flow monitoring should be taken at a minimum. Continuous monitoring of flow would provide the best indication of baseflow and any impact to the surface water flow in Hubbard Creek resulting from dewatering the D seam. Surface flow monitoring in Hubbard Creek will be coordinated with ground water monitoring in order to characterize the interrelationship between surface and ground water in this area. Section 3.6.5, Potential Groundwater Mitigation and Monitoring, discusses the ground water monitoring plan.

SW-9 - Monthly monitoring of flow and quality should be established on Bear and Elk creeks above and below the expected zone of influence from mining the Elk Creek Coal Lease Tract, and this type of monitoring would probably be required under a future mine permit.

3.6 GROUNDWATER

Issue: *Identify and minimize impacts to water quality and hydrology to maintain the integrity of watersheds within and surrounding the lease tract areas. Maintain adequate flows to drainages and ditches above underground mining activity. Areas of concern include: the potential to alter existing hydrologic systems; alteration of downstream flow rates; alteration of existing springs and seeps; changes in water chemistry as a result of mining operations; and, impacts to water rights on Terror Creek, Hubbard Creek, Bear Creek, and Elk Creek.*

3.6.1 Introduction

The study area for groundwater hydrology includes the region within a 1 mile radius of the proposed coal lease tracts and the exploration license area. Particular attention was given to the area of potential subsidence induced impacts (see *Figure 14, Subsidence Potential Map*).

The analysis of groundwater hydrology includes wells, springs and seeps, and stockponds fed by springs. Springs are defined as flowing at a rate of greater than or equal to one gallon per minute (gpm). Seeps flow rates are less than one gpm or are not measurable.

Information for this evaluation was derived from the following sources:

- Groundwater quality and quantity data for area wells and springs from Bowie, Oxbow, USGS, and Hotchkiss Ranches, as well as on-the-ground site visits by the North Fork Coal EIS team;

- Water rights information within a 1 mile radius from the Iron Point and Elk Creek Coal Lease tracts and Iron Point Exploration License area from the Colorado State Engineers Office, Division of Water Resources;

- Review of Bowie and Oxbow data, annual hydrology reports, permit applications, and consultant reports related to groundwater hydrology;

- Regional NEPA documents; and,

- Review of reports, data, and maps compiled by the USGS, Colorado DMG, Forest Service, and BLM.

3.6.2 Affected Environment

3.6.2.1 Regional Hydrogeology

The primary groundwater-bearing zones in the North Fork of the Gunnison River Basin occur in Quaternary alluvial, colluvial, glacial, and eolian deposits and Cretaceous bedrock. Alluvial deposits along the North Fork of the Gunnison River are saturated and considered to be an aquifer. The municipal water supply for the town of Paonia is derived from colluvial springs located on the north side of Mount Lamborn, across the North Fork of the Gunnison River Valley from the project area. Alluvial water-bearing units are thickest in the axis of the drainage bottoms and are typically 100 feet or less in thickness. The water quality of the alluvial groundwater is calcium bicarbonate type and is of good quality. The TDS concentrations of the

groundwater range from 43 to 2,300 mg/l with concentrations of sulfate, TDS, and manganese sometimes exceeding federal drinking water standards. Well yields from this zone range from 1 to 150 gpm and average about 20 gpm (Ackerman and Brooks, 1985).

Colluvial water-bearing units located on valley slopes are generally isolated and are limited in extent. These units are normally saturated seasonally and have a low storage capacity and yield. Most springs and seeps in the region issue from colluvial deposits underlain by less permeable bedrock. Seasonal spring discharge from colluvial deposits ranges from 0.2 to 20 gpm and averages 5 gpm (Ackerman and Brooks, 1985). Colluvial deposits do not represent an aquifer in the region, and no reported wells are developed in this zone. However, numerous seasonal springs and seeps issuing from these zones have been developed for livestock watering and support wildlife. Spring development is usually accomplished by the construction of small stock watering ponds in area drainages.

The primary bedrock water-bearing zones in the North Fork of the Gunnison River basin are in the sandstone and conglomerate units and fractured zones of the Lower Cretaceous Burro Canyon Formation and Late Cretaceous Dakota Sandstone. Minor groundwater occurrence is reported in the Late Cretaceous Mancos Shale, Mesa Verde Formation, and Tertiary Wasatch Formation. Saturated bedrock units are generally confined in nature, except near outcrops where they are typically unconfined.

Well yields from the Burro Canyon Formation/Dakota Sandstone (undifferentiated) are generally greater than 10 gpm (Ackerman and Brooks, 1985). Groundwater from the Mancos Shale is unsuitable for drinking or agricultural use; however, well yields from this formation reportedly range from 0.5 to 15 gpm (Ackerman and Brooks, 1985). Wells completed in the Mesa Verde Formation typically yield less than 10 gpm (Ackerman and Brooks, 1985). Limited data from wells completed in the Wasatch Formation indicate yields as much as 25 gpm (Ackerman and Brooks, 1985). No data is available for other Tertiary age deposits in the region. Spring flow from the Mancos, Mesa Verde, and Wasatch formations ranges from 1 to 25 gpm, averaging 10 gpm (Ackerman and Brooks, 1985).

Water quality from bedrock wells is generally sodium bicarbonate/sulfate type with TDS concentrations ranging from 490 to 8,200 mg/l, averaging 2,569 mg/l. Concentrations of sulfate, TDS, manganese, and fluoride sometimes exceed federal drinking water guidelines (USEPA, 1994). Water collected from springs issuing from bedrock is calcium sulfate type with TDS concentrations ranging from 56 to 4,300 mg/l, averaging 1,956 mg/l (Ackerman and Brooks, 1985). Concentrations of selenium, sulfate, TDS, and manganese sometimes exceed federal drinking water guidelines (USEPA, 1994). See *Figure 19, Groundwater Hydrology*.

Recharge of the water-bearing zones is by seepage from area streams, direct infiltration of precipitation, and snowmelt. Alluvial water-bearing zones are hydraulically connected with adjacent bedrock and intermixing of the two units with groundwater is likely (Ackerman and Brooks, 1985). The shallow alluvial and colluvial groundwater flow follows local topography. The regional bedrock groundwater flow direction is northeast following the regional geologic dip of about 5 degrees. Locally, bedrock groundwater flow paths follow topography and are affected by numerous drainages bisecting the region.

3.6.2.2 Mine Site Hydrogeology

Groundwater occurs within the proposed exploration license area and coal lease tracts in the Quaternary alluvial and colluvial deposits, Wasatch Formation, and Mesa Verde Formation.

Saturated alluvium along the North Fork of the Gunnison River and primary tributary drainages (Terror and Hubbard creeks) has been developed for industrial, domestic, and livestock use. Area well yields range from 5 to 120 gpm and average 17 gpm (Bowie, 1998 and Oxbow, 1999). Several domestic wells are located at the mouths of Terror and Hubbard creeks.

Oxbow utilizes an infiltration gallery for its main fresh water source. The gallery is established in the alluvium of the North Fork of the Gunnison River south of Sanborn Creek. The reported maximum withdrawal rate is about 50 gpm (Oxbow, 1999).

The alluvial groundwater resources in the North Fork of the Gunnison River, as well as in Terror and Hubbard creeks, are elevationally lower than the proposed mined coal seams and are outside the predicted zone of potential mine-induced impacts. Saturated alluvium is unconfined and is recharged primarily by seepage from rivers and streams and, to a minor extent, by discharge from water-bearing bedrock and direct precipitation. Groundwater flow gradient in the alluvium follows the local drainage topography.

Water-bearing colluvial deposits are found along the slopes of area drainages and on the gentle terrain of the ridge tops, as noted by the occurrence of numerous seasonal springs and seeps. These saturated deposits are perched, limited in lateral extent, and are not considered significant water resources. However, several local stockponds are constructed to collect the seasonal spring flow. Local springs and seeps issue from these zones during periods of high precipitation and snowmelt. Seasonal spring and seep flows range from less than 1 gpm to about 5 gpm and are reported to be dry from summer to spring except after major precipitation events. Direct precipitation and snowmelt recharge these deposits. Groundwater is unconfined, and the flow direction follows the local topography.

The Wasatch Formation is composed of interbedded sandstone, siltstone, shale, and claystone. Sandstone beds are generally thin and limited in lateral extent. The Wasatch Formation outcrops on the gentle ridge tops of the Elk Creek Coal Lease Tract and Iron Point Exploration License area. Groundwater occurrence has been identified from numerous seeps and springs. These springs are generally perennial and are associated with thin sandstone outcrops overlying shale or claystone beds. Flow rates typically decrease during the summer and fall seasons (personal communication with Dan Hudson of Hotchkiss Ranches).

Springs and seeps also issue from landslide deposits in the Wasatch Formation where slumping has juxtaposed permeable strata with low permeable material. Slumping features also form catchments that hold snowmelt runoff enhancing recharge potential. Springs that issue from landslide deposits are ephemeral, flowing only during the wet season and during periods of high precipitation (personal communication with Dan Hudson of Hotchkiss Ranches).

The saturated zones in the Wasatch Formation are considered perched and with limited storage potential. Due to the outcrop location and gentle terrain of Wasatch Formation, recharge is primarily from snowmelt and direct precipitation infiltration. Numerous (about 40) local stockponds are fed from springs issuing from the Wasatch Formation. See *Figure 19, Groundwater Hydrology*.

Based on mining and drilling data and spring and seep surveys, groundwater in the Mesa Verde Formation is limited to isolated sandstone beds in the barren and coal bearing members, the Rollins Sandstone member, various coal beds, and along fault and fracture zones. Low primary permeability and limited storage capacity of the Mesa Verde Formation hydrogeologic units limit potential groundwater resource development (Brooks, 1983). However, significant quantities of groundwater are reported where the Mesa Verde Formation is fractured (Brooks, 1983).

Bowie reports perched water-bearing sandstone zones between the Rollins Sandstone and C coal seam and above the D coal seam (Bowie, 1998). The D coal seam is apparently saturated on the west side of Hubbard Creek as indicated by numerous springs and seeps.

Exploration drilling and mining activity at the Oxbow Mine have indicated perched groundwater zones below the E coal seam, in the D coal seam below its outcrop/subcrop with Elk Creek, and in the clastic sequence overlying the C and B coal seams (Oxbow, 1999).

Numerous springs and seeps issue from sandstone beds in the upper Mesa Verde Formation in the proposed Iron Point and Elk Creek Coal Lease tracts and Iron Point Exploration License area. Most of these springs are reported to be perennial (personal communication with J. Stover of Stover & Associates and Dan Hudson of Hotchkiss Ranches).

Spring flows range from less than 1 gpm to about 25 gpm with flow decreasing during dry seasons. Direct precipitation and snowmelt infiltration recharge these deposits. Seepage from local streams provides little recharge due the steep stream gradients and gaining character in the upper drainages where these units outcrop.

Groundwater is unconfined near outcrop and semi-confined to confined in deeper subsurface strata. Groundwater flow direction follows the local topography near drainages and flows to the northeast (regional geologic dip of about 5 degrees) in other areas.

A summary of the spring and seep data is presented in *Table 3.6-1, Spring and Seep Summary - Iron Point Coal Lease Tract and Exploration License Area*, and *Table 3.6-2, Spring, Seep and Pond Summary - Elk Creek Coal Lease Tract*. Locations are shown on *Figure 19, Groundwater Hydrology*.

The Rollins Sandstone member in the proposed coal lease tracts and adjacent areas is unsaturated near the outcrops and becomes saturated down dip to the northeast. The low primary permeability and storage of this unit preclude it as being a significant water-bearing unit. No known water supply wells in the area are developed in the Rollins Sandstone. Drilling and monitoring well data indicates that the Rollins Sandstone is confined with a groundwater flow gradient to the northeast, following the geologic dip of the strata. Infiltration from local drainages crossing outcrops recharges this unit.

Current and historic mining in the area have encountered groundwater in the coal seams and adjacent strata. See *Figure 3, Historic Coal Mines and Federal Coal Lease Locations*, for current and historic mine locations. The Bowie No. 2 Mine is developed in the D seam and reports inflows of less than 1 gpm (Bowie, 1998). The D seam in this area is above outcrop/subcrop with local streams.

The Sanborn Creek Mine is developed in the B and C seams with average inflows of 100 gpm and peak flows of 250 gpm near fractured zones. This mine is situated below the outcrop/subcrop of the North Fork of the Gunnison River.

The Oliver Mine was developed in the D seam mostly above the outcrop/subcrop with Elk Creek. Historic information indicates mostly dry conditions with inflows ranging from 0 to 6 gpm (Oxbow, 1999).

Seeps and springs issue from coal seam outcrops, particularly on the north and east sides of local drainages. The most notable site is located in middle Hubbard Creek drainage where springs and seeps from the D seam outcrops create a marshy area.

Table 3.6-1
Spring and Seep Summary - Iron Point Coal Lease Tract and Exploration Area

Site	Location			Drainage	Flow Rate (gpm)	Origin	Pond or Wetland	Overburden Thickness (D-Seam)	Impact Designation (High, Moderate, Low[3])			
	Northing	Easting	Elevation						Alt. A	Alt. B	Alt. C	Alt. D
S-1	5526.56	16929.41	6990	B Gulch	0-0.94			50	–	–	–	–
S-2	13215.22	16737.20	7920	Freeman Gulch	0-1.66		Pond	1360	L	L	L	L
S-3	13019.03	16256.55	7920	Freeman Gulch	0-3.75			1360	L	L	L	L
S-4[1]	13762.00	15415.42	7660	Terror Creek	0-0.75		Pond P-4	1350	L	L	L	L
S-4a	13999.99	15513.73	7910	Terror Creek	0.36-1.66			1390	L	L	L	L
S-5[1]	14939.20	15962.65	7600	Sheep Corral	0.09-0.54		Pond P-5	1330	L	L	L	L
S-5a	14917.40	15796.79	7650	Sheep Corral	0.16-4.3			1390	L	L	L	L
S-8	6554.664	16515.24	7220	C Gulch	0-2.5			340	H	H	H	H
S-10	6766.37	13910.51	7550	Stevens Draw	0-2.5			750	M	M	M	M
S-11	10746.95	13909.31	7940	Stevens Draw	0			1260	L	L	L	L
S-12	5816.65	15363.64	7640	B Gulch	0			670	H	H	H	H
S-13	10401.77	21709.23	7500	Freeman Gulch	0-0.27			960	M-H	M-H	M-H	M-H
S-14	5816.65	13686.75	7060	Stevens Draw	0.06-1.25		Pond P-1	150	H	H	H	H
S-16[1]	14067.16	14486.69	7760	Terror Creek	0.06-16.75		Pond P-3	1230	L	L	L	L
S-17	11942.72	20346.30	7080	Freeman Gulch	0-16.75	Kmv Ss bed		590	M-H	M-H	M-H	M-H
S-16[1]	15253.54	13956.37	7600	Terror Creek	0-3.75		Pond P-6	1120	–	L	L	–
S2-2	13861.46	22252.46	6760	Hubbard Creek	0-15.5			410	–	H	H	–
S2-3	12626.06	22125.26	6720	Hubbard Creek	0-1.25			340	L	H	H	–
S2-4	11445.35	24310.26	6520	Hubbard Creek	0			140	–	H	H	–

Table 3.6-1
Spring and Seep Summary - Iron Point Coal Lease Tract and Exploration Area

Site	Location			Drainage	Flow Rate (gpm)	Origin	Pond or Wetland	Overburden Thickness (D-Seam)	Impact Designation (High, Moderate, Low[3])			
	Northing	Easting	Elevation						Alt. A	Alt. B	Alt. C	Alt. D
S2-5	10613.71	23746.01	6720	Hubbard Creek	0-0.83			310	L	H	H	--
S2-6	11802.36	23443.25	6660	Hubbard Creek	0-10.71			240	L	H	H	--
S2-7	12095.13	22870.02	6640	Hubbard Creek	0.37.5			270	L	H	H	--
S2-8	12209.00	22454.06	8860	Hubbard Creek	0-1			290	L	H	H	--
S32-2	21740.45	10954.91	7870	Terror Creek	0		Pond 32-2	1430	--	--	--	--
S32-6	17671.69	10737.03	7560	Terror Creek	0-12.1			1160	--	--	--	--
S32-7	22361.73	10617.82	7760	Terror Creek	0-6.05			1550	--	--	--	--
S33-1	21170.09	16656.08	7470	Dove Gulch	0-0.42			1270	--	L	L	--
S33-2	19540.30	17002.08	7570	Dove Gulch	1.09-30			1340	--	L	L	--
S33-4	16007.17	15120.64	7790	Sheep Corral	0		Pond 33-3	1370	--	L	L	--
SP33-5	17531.09	13698.53	7760	Terror creek	0-2.5	Qls	Pond 33-5	1410	--	L	L	--
SP33-6	17552.46	12659.77	7880	Terror Creek	0-0.5	Kmv Ss	Pond 33-6	1260	--	L	L	--
S33-8	17151.92	13667.54	7600	Terror Creek	0-0.5		Pond 33-7	1400	--	L	L	--
S33-9			7440	Dove Gulch	0-3			1380	--	L	L	L
S34-1	20410.96	17472.56	7300	Dove Gulch	0.31-3.95			1110	--	L	L	L
SP34-2	20287.55	17726.19	7260	Dove Gulch	1.91-15		Pond 34-2 Wetland	1120	--	L	L	L
S34-3	20075.34	17926.33	7310	Dove Gulch	0.32-1.7			1130	--	L	L	L
S34-4	19950.26	16116.36	7280	Dove Gulch	1.03-3.95			1100	--	L	L	L
S34-5	19673.63	18422.79	7300	Dove Gulch	0.47-10.71			1120	--	L	L	L
S34-6	22333.91	214473.67	6540	Hubbard Creek	0			540	--	M	M	--

Table 3.6-1
Spring and Seep Summary - Iron Point Coal Lease Tract and Exploration Area

Site	Location			Drainage	Flow Rate (gpm)	Origin	Pond or Wetland	Overburden Thickness (D-Seam)	Impact Designation (High, Moderate, Low[3])			
	Northing	Easting	Elevation						Alt. A	Alt. B	Alt. C	Alt. D
S34-7	16403.34	17421.77	7390	Sheep Corral	0-4.41			960	--	M-H	M-H	M-H
S34-8	20085.27	19128.28	7200	Dove Gulch	0		Wetland	1060	--	L	L	L
S34-9	20179.11	18975.42	7200	Dove Gulch	0.23-42.86		Wetland	1060	--	L	L	L
S34-10	17932.22	21425.85	8640	Dove Gulch	0-11			450	--	H	H	--
SP34-11	16698.56	18907.40	7420	Sheep Corral	0.84-18.75		Pond	1070	--	L	L	L
S34-17	23281.81	21760.72	6600	Hubbard Creek	0-4.17			620	--	--	--	--
S34-18	22993.90	21640.04	6560	Point Gulch	0-1.5			570	--	--	--	--
S34-19	20298.42	21820.75	8480	Hubbard Creek	0-7.5			370	--	H	H	--
S34-20	18729.92	21884.18	6440	Hubbard Creek	0-0.58			280	--	H	H	--
S34-21	17674.15	22213.37	6440	Hubard Creek	0-10.71			250	--	H	H	--
S34-22	17814.92	21554.96	6720	Dove Gulch	0-35			510	--	M	M	--
S34-23	17990.86	21237.54	8660	Dove Gulch	0-75			460	--	H	H	--
S34-24	15960.28	22678.96	6380	Hubbard Creek				180	--	H	H	--
Pond				Terror Creek			Pond P32-3	1320	--	--	--	--
Pond				Freeman Gulch			Pond P-2 Wetland	n.a.	M	M	M	M
Pond				Terror Creek			Pond P33-7	1430	--	L	L	--
PD-82[2]	5570.26	7361.13	7580	Terror Creek			Pond	750	--	L	L	--
6-5[2]	7194.58	5334.93	7600	Terror Creek				1075	--	--	--	--
PD-22[2]	6696.47	6487.10	7520	Terror Creek			Ponds	875	--	--	--	--
7-9[2]	8135.18	4671.55	7800	Terror Creek				1250	--	--	--	--
7-1	10597.83	4851.19	7860	Terror Creek			Pond	1250	--	--	--	--

Table 3.6-1
Spring and Seep Summary - Iron Point Coal Lease Tract and Exploration Area

Site	Location			Drainage	Flow Rate (gpm)	Origin	Pond or Wetland	Overburden Thickness (D-Seam)	Impact Designation (High, Moderate, Low[3])			
	Northing	Easting	Elevation						Alt. A	Alt. B	Alt. C	Alt. D
7-2	10250.11	5432.70	7780	Terror Creek			Pond	1275	--	--	--	--
8-4[2]	7507.02	8514.07	7160	Terror Creek				400	--	--	--	--
PD-21[2]	7339.57	8782.60	7160	Terror Creek			Pond 8-4	275	--	--	--	--
PD-18[2]	11688.97	8008.01	7320	Terror Creek			Pond	775	--	L	L	--
SP5-A[2]	11705.71	7705.92	7320	Terror Creek	1 gpm	Kmv Ss bed	(P18) Wetland	800	--	L	L	--
5-1[2]	11605.24	6782.87	7400	Terror Creek	<1 gpm	Qc		900	--	L	L	--
S5-B	14808.89	9795.83	7280	Terror Creek	2-5 gpm	Kmv Ss bed	Red Hughes	800	--	--	M	--
6-6[2]	11766.31	5018.04	7880	Terror Creek				1250	--	--	--	--
PD-17[1/2]	6170.15	14032.92	7560	Terror Creek			Pond	1100	--	--	L	--
5-2[2]	13053.01	8803.25	7200	Terror Creek	1 gpm	Kmv Ss bed	Wetland	675	--	M	M	--

Notes:

1. Water Right
2. From Bowie No. 1 Spring Survey and Monitoring Network
3. Impact Designation is a qualitative assessment based on predicted subsidence impacts, preliminary mining plans, and potential mine dewatering and recharge.

Springs S-6, 7, 9 & 15 were eliminate during 1997 construction

Table 3.6-2
Spring, Seep and Pond Summary - Elk Creek Coal Lease Tract

Site	Location (GPS date)			Drainage	Flow Rate (gpm)	Origin	Pond or Wetland	Overburden Thickness (D-Seam)	Impact Designation (High, Moderate, Low[3])			
	Northing	Easting	Elevation						Alt. A	Alt. B	Alt. C	Alt. D
ECP-1	12408.15	37991.80	8040	Elk Creek	Goes dry	--	Runoff Pond	1800	L	L	L	L
ECSP-2	19033.35	36479.85	8290	Bear Creek	Perennial	Tw Ss bed	Pond	2400	--	L	L	L
ECSP-3	18884.01	35991.13	8200?	Bear Creek	Perennial	TW Ss bed	Pond	2325	--	L	L	L
ECSP4	13841.79	35390.17	8000	Fire Mtn.	Goes dry	Qls	Pond	1700	--	L	L	L
ECSP-5	18918.19	40222.65	7812	Elk Creek	Perennial	Tw Ss bed	Pond	2150	--	L	L	L
ECP-6	18805.27	40326.32	7800	Elk Creek	Goes dry	--	Runoff Pond	2100	--	L	L	L
ECSP-7	19224.82	39912.94	8858	Elk Creek	Perennial	Tw Ss bed	Pond Wetlands	2225	--	L	L	L
ECP-8	13252.39	40312.46	7950?	Elk Creek		--	Runoff Pond	1625	L	L	L	L
ECSP-9	19252.90	40253.62	8646	Elk Creek	Goes dry	Qls	Pond	2175	--	L	L	L
ECSP-10	19314.32	35547.48	8190	Bear Creek	Perennial	Tw Ss bed	Pond	2475	--	L	L	L
ECP-11	19392.57	35212.93	8244	Bear Creek	Goes dry	--	Runoff Pond	2500	--	L	L	L
ECSP-12	19263.54	35486.48	8125	Bear Creek	Perennial	Tw Ss bed	Pond	2450	--	L	L	L
ECSP-13	19591.55	39866.52	8435	Bear Creek	Perennial	Tw Ss bed	Pond	2300	--	L	L	L
ECP-14	5402.21	30892.71	7300	North Fork	Goes dry	--	Runoff Pond		--	--	--	--
ECSP-15[1]	25054.24	35185.29	7458	Bear Creek	Perennial	Tw Ss bed		2500	--	--	--	--

Table 3.6-2
Spring, Seep and Pond Summary - Elk Creek Coal Lease Tract

Site	Location (GPS date)			Drainage	Flow Rate (gpm)	Origin	Pond or Wetland	Overburden Thickness (D-Seam)	Impact Designation (High, Moderate, Low[3])			
	Northing	Easting	Elevation						Alt. A	Alt. B	Alt. C	Alt. D
ECP-16	19983.20	30877.92	7923	Bear Creek	Never dry	Tw Ss bed	Pond Wetland	1500	--	M	M	M
ECSP-17	25061.07	30831.17	7912	Lone Pine Creek	Perennial	Tw Ss bed	New Pond Wetland	2025	--	--	--	--
ECSP-18	196966.13	26500.94	7916	Bear Creek	Perennial	Tw Ss bed	Pond	1875	--	L	L	L
ECSP-19	19772.29	30395.86	8281	Bear Creek	Perennial	Tw Ss bed	Pond	1475	--	M	M	M
ECP-20	11914.16	36334.47	7740	North Fork	?	--	Runoff Pond	1650	L	L	L	L
ECSP-21	20109.27	30882.45	7800	Lone Pine Creek	Perennial	Tw Ss bed	Pond	1625	--	L	L	L
ECSP-22	25185.68	26399.71	8008	Hubbard Creek		Qls		2075	--	--	--	--
ECP-23	25350.31	30458.98	7710	Lone Pine Creek	Goes dry	--	Runoff Pond	2050	--	--	--	--
ECP-24	19515.87	35391.04	8150?	Bear Creek	Goes dry	--	Runoff Pond	2525	--	L	L	L
ECSP-25	22785.66	40490.32	8250	Elk Creek	Perennial	Tw Ss bed	Pond	2550	--	--	--	--
ECP-26	21470.92	40138.94	8100	Elk Creek	Goes dry	--	Runoff Pond	2475	--	L	L	L
ECP-27	25238.37	30862.60	7635	Elk Creek	Goes dry	--	Runoff Pond	2050	--	--	--	--
ECSP-28	19669.15	26373.42	8271	Bear Creek		Tw Ss bed	Wetland	1775	--	L	L	L
EC-1[2]				Elk Creek		Mvf Ss		n.a	H	H	H	H

Table 3.6-2
Spring, Seep and Pond Summary - Elk Creek Coal Lease Tract

Site	Location (GPS date)			Drainage	Flow Rate (gpm)	Origin	Pond or Wetland	Overburden Thickness (D-Seam)	Impact Designation (High, Moderate, Low[3])			
	Northing	Easting	Elevation						Alt. A	Alt. B	Alt. C	Alt. D
SP-1[2]	11176.25	54501.72		Sanborn Creek			Pond	n.a	--	--	--	--
SP-2[2]	13502.97	54999.94		Sanborn Creek				n.a.	--	--	--	--
SP-3[2]	12776.77	53785.60		Sanborn Creek				n.a.	--	--	--	--
SP-4[2]	14320.94	54966.21		Sanborn Creek			Pond	n.a.	--	--	--	--
SP-5[2]	14276.11	54397.37		Sanborn Creek				n.a.	--	--	--	--
SP-6[2]	12977.77	55407.05		Sanborn Creek			Pond	n.a.	--	--	--	--
SP-7[2]	5656.60	48712.42		Sanborn Creek			Pond	n.a.	--	--	--	--
SP-9[2]	5594.20	46217.00		Sanborn Creek				n.a.	--	--	--	--
SP-10[2]	6130.77	55977.28		Sanborn Creek			Pond	n.a.	--	--	--	--

Notes:
1. Drinking Water Source
2. From Oxbow Mining Spring Survey and Monitoring Network
3. Impact Designation is a qualitative assessment based on predicted subsidence impacts, preliminary mining plans, and potential mine dewatering and recharge.

n.a. - not applicable
Information from Hotchkiss Ranches and EIS team unless noted.

Increased groundwater flow potential is expected near fault and fractured zones in all of the water-bearing strata of the area. However, little information is currently available to confirm this, except where mining operations have crossed fault zones. As stated above, the Sanborn Creek Mine experienced peak inflow rates about 2.5 times greater than average rates when crossing faulted zones (Oxbow, 1999). The Bowie mines have been typically dry, even in fractured terrain.

3.6.2.3 Groundwater Quality

Bowie and Oxbow have collected groundwater quality data for the past several years. Bowie has long term data from monitoring wells and springs at the Bowie No. 1 Mine on the west side of Terror Creek. Bowie has also collected baseline data from numerous springs and wells near the Bowie No. 2 Mine and within the Iron Point Coal Lease Tract.

Oxbow has collected limited baseline data on groundwater quality from their current fee areas for the Sanborn Creek Mine. Baseline data is not available from the Elk Creek Lease Tract area.

For the purpose of this document, the water quality data from the Sanborn Creek monitoring sites are assumed to be similar to the Elk Creek Lease Tract. It is important to note that the Oxbow and Bowie laboratory water quality parameters are slightly different and that the groundwater quality discussions vary accordingly.

A summary of water quality data is presented in *Table 3.6-3, Selected Water Quality Summary - Springs, Alluvial Wells, Drill Holes*. Locations of the monitoring sites are shown on *Figure 19, Groundwater Hydrology*. The following discussion considers average water quality data and parameters that exceed federal primary and secondary drinking water standards (USEPA, 1994).

Iron Point Exploration License Area and Coal Lease Tract - The groundwater quality in the Iron Point Coal Lease Tract and Iron Point Exploration License area varies depending on the geologic unit. The water quality from the alluvial monitoring wells located in the drainages below the Bowie No. 2 Mine (B Gulch and C Gulch) is calcium sulfate type. Water quality is poor with high concentrations of TDS, aluminum, iron, sulfate, and manganese. An alluvial monitoring well installed in the Freeman Gulch (DH-34C) has calcium bicarbonate type water with high concentrations of iron. The groundwater quality of the alluvial wells is similar to the surface water quality in the respective drainages indicating a connectivity between ground and surface water. The high sulfate concentration in ground and surface water of the mine drainages, B Gulch and C Gulch, indicate impacts from past mining activity. Historic waste coal materials and mine portals are located in the B and C gulches below the Bowie No. 2 Mine (personal communication with Greg Hunt, Bowie). Seepage from these sites likely impacts the TDS, sulfate, iron and manganese concentrations in the surface water and associated shallow groundwater.

Other monitoring wells are installed in the D coal seam overburden, D coal seam, and Rollins Sandstone. Two wells (DH-39 and 49) are installed in the overburden directly above the D seam. The water quality of these wells is sodium/calcium bicarbonate type with high concentrations of TDS, iron, sulfate, and manganese. The water quality from the well installed in the Rollins Sandstone (DH-34B) is sodium bicarbonate type with high concentrations of TDS, sulfate, iron and chloride. Water quality from wells installed in the D coal seam is sodium bicarbonate and sodium sulfate type with high concentrations of TDS, sulfate, iron, and manganese.

Table 3.6-3
Selected Water Quality Summary - Springs, Alluvial Wells, Drill Holes

	Bicarbonate	Chloride	TDS	Sulfate	Aluminum (T)	Calcium (T)	Iron (T)	Lead (T)	Magnesium (T)	Manganese (T)	Sodium (T)	Zinc (T)
Water Quality Std. (Mg/l)		250	500	250	0.2		0.3	0.015		0.05		5
Iron Point - Springs												
S-16												
No. of Samples	5	5	5	5	5	5	5	5	5	5	5	5
Minimum	107	0.5	140	5	0.03	18.2	0.03	0.01	3.2	-0.005	10.5	-0.01
Maximum	159	5	190	12	0.17	35.1	0.49	0.02	6.5	0.017	18.2	0.02
Average	129	1.9	164	6	0.07	28.7	0.15	0.01	5.3	0.006	15.44	0.012
Standard Deviation	20	1.8	24	3	0.06	6.5	0.20	0.01	1.3	0.006	3.0713	0.0076
S-17												
No. of Samples	4	4	4	4	4	4	4	4	4	4	4	4
Minimum	266	2	300	20	0.1	42	0.1	0.01	17.5	-0.005	3.83	-0.01
Maximum	298	3	380	30	5.42	55	6.08	0.02	19	0.094	62.7	0.04
Average	280	2.5	342	27.5	2.52	50	2.80	0.02	18.1	0.038	47.7	0.0237
Standard Deviation	13	0.6	35	5	2.67	6	2.98	0.01	0.7	0.042	10.67	0.0149
S33-2												
No. of Samples	3	3	3	3	3	3	3	3	3	3	3	3
Minimum	218	2	260	30	0.1	29.1	0.04	0.02	6.5	-0.005	59.3	-0.01
Maximum	272	4	340	60	0.64	42.9	0.52	0.1	9.2	0.013	75.7	0.02
Average	244	3	307	43	0.31	38.3	0.25	0.05	8.2	0.007	67.9	0.01
Standard Deviation	27	1	42	15	0.29	7.9	0.24	0.05	1.5	0.005	8.2	0.01

Table 3.6-3
Selected Water Quality Summary - Springs, Alluvial Wells, Drill Holes

	Bicarbonate	Chloride	TDS	Sulfate	Aluminum (T)	Calcium (T)	Iron (T)	Lead (T)	Magnesium (T)	Manganese (T)	Sodium (T)	Zinc (T)
Water Quality Std. (Mg/l)		250	500	250	0.2		0.3	0.015		0.05		5
S34-9												
No. of Samples	3	3	3	3	3	3	3	3	3	3	3	3
Minimum	250	7	400	90	0.11	49.4	0.09	-0.04	12.1	-0.005	76.4	-0.01
Maximum	290	9	460	100	25.5	75.2	27.8	-0.2	18.2	0.545	86.5	0.011
Average	275	8	427	93	8.60	60.5	9.34	0.05	14.6	0.186	80.7	0.04
Standard Deviation	22	1	31	6	14.63	13.3	15.99	0.05	3.2	0.311	5.2	0.06
SP34-2												
No. of Samples	3	3	3	3	3	3	3	3	3	3	3	3
Minimum	48	-1	90	5	0.09	11.1	0.08	-0.04	3.7	-0.005	3.4	-0.01
Maximum	265	4	320	50	0.92	40.5	0.76	-0.04	8.4	0.041	81	0.01
Average	184	3	237	32	0.47	29.1	0.43	0.02	6.7	0.02	48.7	0.01
Standard Deviation	118	2	127	24	0.42	15.8	0.34	0	2.6	0.02	40.4	0.003

Table 3.6-3
Selected Water Quality Summary - Springs, Alluvial Wells, Drill Holes

	Bicarbonate	Chloride	TDS	Sulfate	Aluminum (T)	Calcium (T)	Iron (T)	Lead (T)	Magnesium (D)	Manganese (T)	Sodium (D)	Zinc (D)
Water Quality Std. (Mg/l)		**250**	**500**	**250**	**0.2**		**0.3**	**0.015**		**0.05**		**5**
Iron Point - Alluvial Wells												
AW-1												
No. of Samples	7	7	7	7	1	1	7	1	6	7	6	6
Minimum	453	38	3100	1830	0.33	126	0.13	-0.04	157	-0.03	716	-0.05
Maximum	657	79	8710	8330	0.33	126	1.69	-0.04	533	0.16	1700	-0.3
Average	561	58	5920	4097	0.33	126	0.74	0.02	310	0.039	1276	0.02
Standard Deviation	90	17	2365	2314	0	0	0.50	0	158	0.06	404	0.01
AW-3												
No. of Samples	7	7	7	7	1	1	7	1	7	7	6	6
Minimum	615	46	1750	760	0.4	206	0.78	0.02	164	0.051	132	-0.01
Maximum	1100	136	2440	960	0.4	206	27.5	0.02	205	0.14	445	-0.1
Average	817	86	2187	887	0.4	206	12.7	0.02	186	0.10	306	--
Standard Deviation	203	38	232	66	0	0	8.8	0	13	0.03	140	--
AW-4												
No. of Samples	7	7	7	7	1	1	7	1	7	7	6	6
Minimum	609	49	3810	2120	0.12	327	0.1	0.02	233	0.183	478	-0.02
Maximum	790	63	5330	3220	0.12	327	0.45	0.02	362	1.21	702	-0.3
Average	679	55	4517	2501	0.12	327	0.25	0.02	299	0.62	568	--
Standard Deviation	80	5	631	412	0	0	0.13	0	60	0.36	80	--

Table 3.6-3
Selected Water Quality Summary - Springs, Alluvial Wells, Drill Holes

	Bicarbonate	Chloride	TDS	Sulfate	Aluminum (T)	Calcium (T)	Iron (T)	Lead (T)	Magnesium (D)	Manganese (T)	Sodium (D)	Zinc (D)
Water Quality Std. (Mg/l)		**250**	500	250	0.2		0.3	**0.015**		**0.05**		**5**
AW-5												
No. of Samples	7	7	7	7	1	1	7	1	7	7	6	6
Minimum	566	29	5380	1840	0.08	317	0.1	0.04	615	0.009	514	-0.03
Maximum	768	52	6690	4550	0.08	317	0.47	0.04	731	0.02	620	0.03
Average	702	40	5931	3514	0.08	317	0.27	0.04	661	0.013	553	0.02
Standard Deviation	66	9	483	846	0	0	0.14	0	40	0.004	39	0.01
AW-6												
No. of Samples	7	7	7	7	1	1	7	1	7	7	6	6
Minimum	278	71	3640	1740	1.04	257	0.24	0.02	273	0.015	446	-0.02
Maximum	386	120	4360	2510	1.04	257	1.03	0.02	340	0.29	540	0.11
Average	353	90	3973	2206	1.04	257	0.56	0.02	304	0.13	490	0.03
Standard Deviation	37	19	283.2	276	0	0	0.33	0	27	0.10	38	0.04
Iron Point - Drill Holes												
DH-15												
No. of Samples	8	8	8	3	--	--	8	--	8	8	8	8
Minimum	441	23	1140	5	--	--	0.17	--	0.4	-0.005	467	-0.01
Maximum	1200	28	1270	30	--	--	0.93	--	2.3	0.028	535	0.04
Average	1016	25	1191	18	--	--	0.435	--	0.8	0.011	509	0.02
Standard Deviation	238	2	40	14	--	--	0.258	--	0.7	0.008	24	0.01

Table 3.6-3
Selected Water Quality Summary - Springs, Alluvial Wells, Drill Holes

	Bicarbonate	Chloride	TDS	Sulfate	Aluminum (T)	Calcium (T)	Iron (T)	Lead (T)	Magnesium (D)	Manganese (T)	Sodium (D)	Zinc (D)
Water Quality Std. (Mg/l)		250	500	250	0.2		0.3	0.015		0.05		5
DH-16												
No. of Samples	8	8	8	8	- -	- -	8	- -	8	8	8	8
Minimum	987	23	2890	1290	- -	- -	0.78	- -	48	0.11	944	-0.01
Maximum	1200	34	3330	1520	- -	- -	14.4	- -	62	4.03	1090	0.04
Average	1105	30	3171	1419	- -	- -	4.0	- -	57	0.70	1037	0.04
Standard Deviation	62	4	154	86	- -	- -	4.4	- -	5	1.35	50	0.05
DH-25												
No. of Samples	8	8	8	8	- -	- -	8	- -	8	8	8	8
Minimum	1730	77	2200	30	- -	- -	0.54	- -	13.2	0.03	1220	-0.01
Maximum	2640	110	3280	600	- -	- -	1.97	- -	18.4	0.09	1340	-0.3
Average	2396	100	2963	258	- -	- -	1.12	- -	15.4	0.05	1291	- -
Standard Deviation	306	13	334	224	- -	- -	0.57	- -	1.9	0.02	43	- -
DH-34C												
No. of Samples	8	8	8	8	- -	- -	8	- -	8	8	8	8
Minimum	118	-1	100	5	- -	- -	0.1	- -	6	0.005	14.8	-0.01
Maximum	156	4	190	20	- -	- -	2.0	- -	10	0.041	23.3	0.02
Average	138	2	162	11	- -	- -	0.5	- -	8	0.011	19.8	0.01
Standard Deviation	16	1	31	6	- -	- -	0.6	- -	1	0.012	3.1	0.01

Table 3.6-3
Selected Water Quality Summary - Springs, Alluvial Wells, Drill Holes

	Bicarbonate	Chloride	TDS	Sulfate	Aluminum (T)	Calcium (T)	Iron (T)	Lead (T)	Magnesium (D)	Manganese (T)	Sodium (D)	Zinc (D)
Water Quality Std. (Mg/l)		250	500	250	0.2		0.3	0.015		0.05		5
DH-39												
No. of Samples	8	8	8	8	- -	- -	8	--	8	8	8	8
Minimum	545	16	780	190	- -	- -	0.3	- -	72	0.057	137	-0.01
Maximum	603	20	900	260	- -	- -	25.5	- -	91	0.31	167	0.03
Average	576	18	841	217	- -	- -	10.8	- -	80	0.16	150	0.01
Standard Deviation	21	1	43	24	- -	- -	9.2	- -	7	0.10	0 11	0.01
DH-49												
No. of Samples	8	8	8	8	- -	- -	8	- -	8	8	8	8
Minimum	496	14	700	180	- -	- -	0.2	- -	1.6	0.0025	5.2	-0.01
Maximum	1540	20	2540	690	- -	- -	47.8	- -	59	0.738	947	0.01
Average	864.625	16.625	1385	363	- -	- -	11.595	- -	40	0.18769	353	0.01
Standard Deviation	433.054	2.2638	762.1	196	- -	- -	17.554	- -	18	0.25408	374	0.002

Table 3.6-3
Selected Water Quality Summary - Springs, Alluvial Wells, Drill Holes

	Bicarbonate	Chloride	TDS	Sulfate	Aluminum (D)	Calcium (T)	Iron (T)	Lead (D)	Magnesium (D)	Manganese (T)	Sodium (D)	Zinc (D)
Water Quality Std. (Mg/l)		250	500	250	0.2		0.3	0.015		0.05		5
ELK CREEK												
B-6												
No. of Samples	27[1]	29	30	29	--	29	30	- -	29	5		29
Minimum	272	1	302	0.5	-	0.9	1.68	--	0.06	0.152		-0.005
Maximum	3380	446	4890	820	-	49	176	--	29	0.5		0.69
Average	1006	131	1343	59	-	11	34	--	4.20	0.32		0.13
Standard Deviation	821	122	1075	154	--	11	41	--	6.2	0.14		0.18
H-10												
No. of (1) Samples	35	35	36	35	--	35	36	--	34[1]	5		34
Minimum	940	4	2688	1	-	-0.005	0.22	--	2	0.03		-0.005
Maximum	2920	1070	4780	1140	-	116	39	--	42	0.16		0.415
Average	2320	310	2983	94	-	14.53	8.39	--	0.21	0.10		0.096
Standard Deviation	480	153	350	275	--	24.76	7.47	--	8	0.06		0.120
EC-1												
No. of Samples	9	11	11	11	--	11	9	--	11	--		11
Minimum	73.2	-0.001	0.45	37.5	-	-0.001	0.22	--	0.001	--		-0.001
Maximum	578.28	20	800	145	-	73.6	3.55	--	22.08	--		0.696
Average	434.85	8.67	503.6	89.55	-	37.06	0.99	--	14.44	--		0.074
Standard Deviation	163.89	6.93	227.1	30.89	--	26.99	1.12	--	6.42	--		0.210

Table 3.6-3
Selected Water Quality Summary - Springs, Alluvial Wells, Drill Holes

	Bicarbonate	Chloride	TDS	Sulfate	Aluminum (D)	Calcium (T)	Iron (T)	Lead (D)	Magnesium (D)	Manganese (T)	Sodium (D)	Zinc (D)
Water Quality Std. (Mg/l)		**250**	**500**	**250**	**0.2**		**0.3**	**0.015**		**0.05**		**5**
SC-1												
No. of Samples	24	24	25	24	-	24	25	--	24	10		24
Minimum	1452	1175	2330	1	-	17.2	0.29	--	6	0.014		0.005
Maximum	4033	6680	11373	88	-	61	15.5	--	20	0.26		4.8
Average	2947	3562	8311	18.3	-	24.7	3.9	--	11.7	0.106		0.311
Standard Deviation	795	1137	1956	23	-	8.7	3.6	--	2.4	0.067		0.966
SC-2												
No. of Samples	23 (1)	25	26	25	-	25	28	--	25	10		22
Minimum	23	17	720	2	-	1	-0.01	--	-1	-0.01		-0.005
Maximum	3841	8800	15290	412	-	326	22.9	--	43	0.104		0.1
Average	2059	4561	10688	56	-	24	3.9	--	9	0.025		0.026
Standard Deviation	1182	2402	3991	80	-	65	5.1	--	10	0.030		0.031
SC-3												
No. of Samples	23	23	24	23	--	23	24	--	23	10		23
Minimum	336	6	408	14	-	46.5	0.27	--	17	0.1		-0.005
Maximum	567	117	1044	412	-	80	67.2	--	43	0.35		0.33
Average	451	26	651	133	-	57.8	17.29	--	23.9	0.21		0.04
Standard Deviation	64	26	143	100	--	11.2	14.55	--	8.1	0.08		0.0715

Reference for Standards: EPA. Primary Drinking Water Standards, Colorado Department of Health, North Fork Gunnison River.
- - Denotes less than detection limit.
Average and standard deviation calculated by assuming concentrations less than detection limit equal to ½ of the detection limit.
(1) Concentration of "zero" in database was omitted in statistical calculations.

Spring water quality is similar throughout the area and is calcium/sodium bicarbonate type, typically with high concentrations of aluminum, iron, and manganese. Several springs had lead concentrations slightly above laboratory detection limits. Spring S-18 was the only site with sodium sulfate type water.

Elk Creek Coal Lease Tract - Site specific groundwater quality information is limited for the Elk Creek Coal Lease Tract area. The following discussion is based on groundwater quality data from the Sanborn Creek Mine area (Oxbow, 1999). It is assumed that the groundwater quality in the Sanborn Creek Mine area is similar to the Elk Creek Coal Lease Tract.

Monitoring sites include wells, springs and mine discharge. Groundwater zones are separated by geologic units including alluvial/colluvial, perched (clastic beds and coal seams in the Wasatch and Mesa Verde formations), D coal seam, B coal seam, and Rollins Sandstone. The alluvial/colluvial groundwater is collected from the Oxbow infiltration field installed in the North Fork of the Gunnison River alluvium. The groundwater from this site is calcium sulfate type with low concentrations of trace constituents. Generally, the quality of the alluvial/colluvial groundwater is good and suitable for domestic use with only minimal treatment (chlorination).

The perched water quality data is derived from eleven springs (EC-1, SP-1 through 7, and SP-9 through 11), and two monitoring wells (TC-1, and TC-2). The perched water quality is generally calcium sulfate to sodium bicarbonate type with moderately high concentrations of TDS, iron, and manganese.

Two wells (SC-3 and EC-6) and the Oliver Mine discharge spring are used to monitor D coal seam water quality. Water quality from the D coal seam is sodium bicarbonate type with high concentrations of TDS, iron, and manganese and sometimes sulfate. Water quality from wells (B-6 and H-10) installed in the historic Somerset Mine workings (B seam) and mine water inflow sites (MWM-1, MWS-A through D) is sodium bicarbonate type with high concentrations of TDS, iron, manganese, and sometimes chloride and sulfate.

The water quality from the two wells installed in the Rollins Sandstone (SC-1and SC-2) is sodium bicarbonate type with high concentrations of TDS, iron and manganese.

3.6.2.4 Seasonal Trends in Groundwater Quality

Iron Point Exploration License Area and Coal Lease Tract - Review of Bowie water quality data from monitoring wells and springs does not reveal any general seasonal trends in groundwater quality at the study area. This is likely due to the relatively short period of record for most sampling sites. Alluvial well data has been collected quarterly since 1997. Bedrock monitoring well data has been collected since 1995, and spring data has been collected sporadically since late 1997. Seasonal groundwater quality trends will likely become more defined when more consistent water quality data becomes available. Typically, seasonal trends include increased concentrations of TDS and dissolved constituents and high groundwater levels in the spring.

Elk Creek Coal Lease Tract - No site specific groundwater quality data is available for the Elk Creek Lease Tract.

3.6.2.5 Influence of Past and Current Activities on Groundwater Quality

Iron Point Exploration License Area and Coal Lease Tract - Past and current mining activities have affected groundwater quantity and quality. Current mining activities at the Bowie No. 2 Mine do not utilize any groundwater for operations. Fresh water for the operation comes

from the Deertrail Ditch. The Bowie No. 1 and No. 2 mines are essentially dry, and dewatering has not been necessary. As a result, there have not been any impacts to groundwater due to water consumption or dewatering activities.

Historic mining activities at the King Mine in the drainages below the Bowie No. 2 Mine have apparently impacted the local alluvial groundwater quality. Two mine portals and associated coal fines/waste are located in the A and B/C Gulches. Seepage from these sites has caused high sulfate and other trace constituent levels in groundwater at the down gradient alluvial monitoring wells (AW-1, 3, 4, 5, and 6). No other impacts have been noted in this area.

Past and current activities other than mining have affected groundwater quality. Livestock grazing causes minor impacts to springs and seeps due to erosion, sedimentation, and water quality, (i.e. fecal coliform). Unauthorized off-road vehicle use also causes erosion and sedimentation that effect spring areas. Individual domestic water wells and community water wells have had limited impact on groundwater quantity. Rural septic systems may impact local groundwater quality.

Elk Creek Coal Lease Tract - Due to the limited amount of groundwater monitoring at the Elk Creek Coal Lease Tract, impacts due to past and current mining activities are difficult to analyze. The Blue Ribbon Mine, located in Hubbard Creek, has been abandoned and reclaimed. Surface water quality in Hubbard Creek has not been adversely impacted (see Section 3.5, Surface Water Hydrology) as a result of historic Blue Ribbon Mine operations. As a result, it is not believed that groundwater quality has been impacted. A field survey of the site did not show any mining related impacts to the Hubbard Creek drainage. Mine discharge from the abandoned Oliver Mine (SP-8) and the Hawks Nest Mine (SP-11) is fair to good quality with somewhat elevated levels of TDS, iron, and manganese. These mines are located east of the Elk Creek Coal Lease Tract. See *Figure 3, Historic Coal Mines and Federal Coal Lease Locations.*

The active Sanborn Creek Mine has been storing discharge mine water in sumps in the B and C coal seams since 1992. The B and C seams were dry during active mining. Water quality data indicates that the stored mine water meets NPDES effluent limitations with minor treatment to reduce TDS concentrations (Oxbow, 1996). There may be some seepage from the storage sumps down dip in the coal horizon or to adjacent bedrock units; however the quality of the seepage is fair to good, and seepage rates are likely very small. The West Elk Mine, located south of the Elk Creek Coal Lease Tract, operates under an NPDES discharge permit with strict effluent quality standards. There are no known impacts to groundwater quality due to these operations.

3.6.2.6 Groundwater Use

Water rights and well records from the Colorado Division of Water Resources were reviewed for the area of the proposed coal lease tracts, exploration license area, and areas extending about 1 mile outside of these boundaries. Sites located within or west of Hubbard Creek were considered in the Iron Point Coal Lease Tract and Exploration License area. Those east of Hubbard Creek are considered in the Elk Creek Coal Lease Tract area. A summary of the groundwater rights and wells is presented in *Table 3.5-3, Water Rights Summary for Wells, Springs and Surface Water*, (see Section 3.5, Surface Water Hydrology). Locations of the water rights are shown on *Figure 18, Water Rights.*

Iron Point Exploration License Area and Coal Lease Tract - There are five adjudicated water rights associated with springs in the Iron Point Coal Lease Tract and Exploration License area. Four adjudicated water rights are on private surface (J&M Spring and Pipeline 1- 4) and

one is on BLM surface (J&B Spring and Pipeline 5). These sites are used for stock watering purposes.

Six adjudicated water rights associated with wells are located in or around the Iron Point Coal Lease Tract and Exploration License Area. All but the Blue Ribbon well are located along the North Fork of the Gunnison River and are apparently installed in saturated alluvium. The Blue Ribbon well is located in Hubbard Creek adjacent to the historic Blue Ribbon Mine. This well is installed in the alluvium of Hubbard Creek and has not been in use since the Blue Ribbon Mine was closed.

The King Clay well is located on the West Fork Terror Creek. This shallow well is installed in the alluvium along West Fork Terror Creek and is for domestic use. The Peggy Seabloom well is located on the East Fork Terror Creek, about a mile west of Terror Creek Reservoir. This shallow well is installed in the alluvium along East Fork Terror Creek and is for domestic use.

Elk Creek Coal Lease Tract - There are no adjudicated water rights associated with springs in the Elk Creek Lease Tract area.

Two adjudicated water rights associated with wells are located near the Elk Creek Coal Lease Tract (Bear No. 1 and Somerset Mine wells). These wells are located along the North Fork of the Gunnison River and are apparently installed in saturated alluvium. All other active registered wells without water rights are used only for monitoring.

3.6.3 Environmental Consequences

Coal mine development in the Iron Point and Elk Creek Coal Lease tracts and exploration activities on the Iron Point Exploration License area could potentially result in some impacts to area groundwater resources.

Longwall mining causes bedrock fracturing and land subsidence above longwall panels. By potentially providing pathways for groundwater to move downward toward the mined horizon, fracturing and subsidence may divert water from saturated horizons and surface water bodies above and adjacent to caved areas. Impacts to groundwater systems may potentially result in the decrease in natural discharge rates from springs and seeps or change water levels and yields in area wells. Potential effects include the following.

- Mining would dewater the coal seam and water-saturated horizons immediately above and below the coal seam.
- Water quality could be degraded when groundwater flows through active or abandoned mine workings.
- Transbasin diversion of groundwater resulting from dewatering of the coal seam is a potential impact.
- Water rights could be affected if area spring flows and associated pond levels and well water levels are diminished.
- Increased sedimentation of area springs from construction and use of surface facilities (exploration drill pads and associated access roads) could occur.
- Accidental fuel or solvent spills could impact shallow groundwater locally.

The criteria for significant impacts refer to adverse impacts to the quality or quantity of groundwater utilized for important uses such as domestic water supply, livestock watering, springs that recharge wetland/riparian areas or support wildlife habitat, and natural resource values.

It is important to note that subsidence induced impacts to groundwater resources were calculated from the reasonably foreseeable development scenarios and generalized overburden strata characteristics for the Iron Point and Elk Creek Coal Lease tracts. It was also assumed that coal would be extracted to the limits of the lease tract boundaries using longwall mining techniques. Actual mining plans could be different.

Exploration activities should not noticeably impact groundwater resources. The strata are not uniformly saturated, so there is little concern for inter-aquifer communication. The drill holes would be of small diameter and would cause little disturbance to the geologic strata.

3.6.3.1 Effects of Alternative A (No-Action)

Direct Effects - Under this alternative, the coal lease tracts would not be offered for lease, and mine development would not occur. As a result, there would be no mining related impacts to groundwater resources in the Iron Point and Elk Creek Coal Lease tracts or from exploration activities in the Iron Point exploration license area. Existing impacts to groundwater from past and current land uses would continue.

The Bowie No. 2 Mine and Sanborn Creek Mine would continue to operate under their current permits. The Bowie No. 2 Mine would develop north and east to the proposed Iron Point Coal Lease Tract boundary. As a result of this development, there is potential for subsidence related impacts to groundwater resources. Several seasonal springs in this area could be impacted including S-8 and S-13 (see *Figure 14, Subsidence Potential Map*). The Bowie No. 2 Mine is expected to be dry, and no impacts to groundwater resources from dewatering are expected.

Oxbow would develop the Elk Creek Mine on fee (private) coal reserves. As a result of this development, there would be the potential for subsidence and dewatering related impacts to groundwater resources. The subsidence impact evaluation completed for this document indicates potential impacts to groundwater resources near the D seam outcrops in Bear and Elk creeks. Several seasonal springs in this area could be impacted including the Elk No. 1 (see *Figure 14, Subsidence Potential Map*). Dewatering could temporarily disrupt local groundwater recharge and discharge. The regional groundwater flow gradient in the area is to the northeast. Theoretically, groundwater flow in the D coal seam in the Elk Creek Mine area discharges to some point outside the north Fork of the Gunnison drainage basin area. Mine development may require dewatering of the D coal seam and the water would be discharged to the North Fork of the Gunnison. This may represent a transbasinal diversion of groundwater.

After mining, the mine voids would fill with groundwater to near pre-mining levels. The groundwater would be exposed to collapsed and abandoned mine workings, and the quality of the water may be impacted. The most likely impact would be an increased concentration of TDS, iron, manganese, and possibly sulfate. The groundwater flow direction in the D seam horizon is to the northeast beneath Grand Mesa. There are no known wells or springs down-gradient of the Elk Creek Coal Lease Tract that would be affected by any possible groundwater degradation.

3.6.3.2 Effects Common to All Action Alternatives

Various mine-induced subsidence parameters were analyzed for the Iron Point and Elk Creek Coal Lease Tract areas. These include:

- Maximum vertical displacement,
- Tilt,
- Horizontal strain,
- Angle of draw, and
- Break angle.

Subsidence-induced impacts to groundwater resources are primarily related to the break angle. The break angle defines the zone of maximum tensile strain above a mining panel. Most subsidence induced cracks in the overburden and at the surface occur in the zone of maximum tensile strain. Subsidence induced impacts to groundwater resources are rated as very low to low, low to moderate, moderate to high, and high to very high. In general, subsidence impacts are considered high with overburden thickness less than 500 feet, moderate with overburden between 500 and 1,000 feet thick, moderate to low with overburden between 1,000 and 1,500 feet thick, and low to very low with thickness above 1,500 feet. *Figure 14, Subsidence Potential Map*, illustrates the potential zones of mining induced subsidence impacts to water resources. Two areas of high to moderate impacts have been identified for the Hubbard Creek and Terror Creek drainages.

Direct Effects - Iron Point Exploration License Area and Coal Lease Tract - Under Alternatives B, C, and D, the Iron Point Exploration License area would be granted and the Iron Point Coal Lease Tract would be offered for competitive leasing.

Completion of the exploration drilling program is not expected to cause impacts to groundwater resources.

Longwall mining development of the Iron Point Coal Lease Tract would induce subsidence of the overlying ground surface. The extent, severity, and potential impact to water resources due to subsidence is dependent on the thickness, composition, and geotechnical properties of the overburden, thickness of the mined coal, and mining plans. Mining would also result in dewatering of saturated zones of the mined horizon. Mined areas would likely refill with water to approximate pre-mining levels after mining operations cease which could impact groundwater quality.

Subsidence could potentially disrupt or alter springs, seeps, ponds, and change local groundwater levels directly above the underground mine and within the angle of draw. The only areas within the coal lease tract with a high to moderate potential for impacts are Hubbard Creek and Terror Creek. See *Figure 14, Subsidence Potential Map*.

The D coal seam outcrop in the Hubbard Creek drainage is saturated. Seeps and springs from the outcrop create a marsh in the valley floor near the historic (now abandoned) Blue Ribbon Mine. Mining of the D coal seam would dewater this zone and may temporarily dry the strata, springs, and seeps.

After mining, the eastern section of the mine would fill with groundwater to approximately pre-mining levels. The groundwater would be exposed to collapsed and abandoned mine workings, and the quality of the water may be impacted. The most likely impact would be an increased concentration of TDS, iron, manganese, and possibly sulfate. This would impact the water quality of the springs and seeps issuing from the D coal seam outcrop.

No groundwater rights are located in the areas of potential impacts. However, water rights associated with seeps and springs are considered surface water rights, and are discussed in Section 3.5, Surface Water Hydrology.

Direct Effects - Elk Creek Coal Lease Tract - Small areas in the southern portion of the Elk Creek Coal Lease Tract along the east side of Hubbard Creek and in Bear Creek have a high to moderate potential for subsidence induced impacts to water resources (*Figure 14, Subsidence Potential Map*). Most of the Elk Creek Coal Lease Tract has an overburden thickness between 1,500 and 2,500 feet with low to very low potential for impacts.

It is believed that the D coal seam is saturated throughout most of the Elk Creek Coal Lease Tract. Mining would require dewatering of this zone. Mine water would likely be stored in sumps located in abandoned mine workings, treated if necessary, and discharged to the North Fork of the Gunnison River at a permitted outfall site. Mine discharge water quality would have to meet permitted effluent requirements. The regional groundwater flow gradient in the area is to the northeast. Theoretically, groundwater flow in the D coal seam, east of the surface outcrops, will discharge to some point outside the North Fork of the Gunnison River drainage basin area. Mine development may require dewatering of the D coal seam. Mine water would be treated, if necessary, and discharged to the North Fork of the Gunnison River. This may represent a transbasinal diversion of groundwater. The estimated mine water discharge volume has not been determined.

After mining, the mine voids would fill with groundwater to approximately pre-mining levels. The groundwater would be exposed to collapsed and abandoned mine workings, and the quality of the water may be impacted. The most likely impact would be an increased concentration of TDS, iron, manganese, and possibly sulfate. The groundwater flow direction in the D coal seam horizon is to the northeast, beneath Grand Mesa. There are no known wells or springs down-gradient of the Elk Creek Coal Lease Tract that would be affected by any possible groundwater degradation.

Petroleum, oils, and lubricants are regularly used in mining operations. These materials may degrade discharge water quality if they are mishandled or abandoned underground and exposed to water passing through the mine. Any toxic or hazardous materials which are used underground should be removed from the mine prior to closure. It is assumed for this analysis that mining equipment would also not be abandoned underground.

No groundwater rights are located in the areas of potential impacts. However, water rights associated with seeps and springs are considered surface water rights, and are discussed in Section 3.5, Surface Water Hydrology.

Indirect Effects - Study Area - The potential for indirect groundwater impacts in the study area is expected to be minimal. If mine employees choose to live in rural areas, private domestic wells would be drilled and septic systems would be installed. Appropriate state and county regulations would have to be followed, minimizing impacts to groundwater quantity and quality.

Methane release from coal mines would not be expected to impact domestic water wells, particularly in Garvin Mesa because the wells are below the coal seams to be mined. In the Garvin Mesa area, the coal has eroded away and does not have any contact with water below the outcrop of the Rollins Sandstone. The Rollins Sandstone is approximately 120 feet above Garvin Mesa.

3.6.3.3 Effects of Alternative B

Completion of the exploration drilling program is not expected to cause impacts to groundwater resources.

Longwall mining development in the D coal seam of the Iron Point Coal Lease Tract would induce subsidence of the overlying ground surface and temporarily dewater the strata adjacent to the D coal seam. After mining, the D coal seam zone would likely flood to approximate pre-mining levels which could impact groundwater quality.

The southeast corner of the lease tract in the Hubbard Creek drainage is located in an area of high potential subsidence impacts with overburden thickness less than 500 feet. Nine seasonal springs are located in this area (S2-2, 3, 4, 5, 6, 7, 8 and S34-20, 21, and 24) and would likely be impacted. No perennial springs are located in this area.

Portions of Terror Creek would be subsided under this alternative; however, there are no springs identified in the high to very high subsidence zone in Terror Creek (see *Figure 14, Subsidence Potential Map*). Given the low overburden present, subsidence fracturing could interrupt groundwater seepage entering the drainages from saturated colluvial and alluvial material in the drainage bottoms.

Small areas in the southern portion of the Elk Creek Coal Lease Tract along the east side of Hubbard Creek and in Bear Creek have high to moderate potential for subsidence induced impacts to water resources. No known groundwater resources are located in these areas and no impacts are anticipated. Most of the Elk Creek Tract has overburden thickness between 1,000 and 2,500 feet which would have moderate to very low potential for subsidence impacts.

Dewatering impacts and water quality impacts for Alternative B would be the same as those discussed in Section 3.6.3.2, Effects Common to All Action Alternatives.

3.6.3.4 Effects of Alternative C

Alternative C allows for multiple seam mining (B and D seams) in the Iron Point Coal Lease Tract with minor lease boundary adjustments.

Multiple seam mining would have a cumulative effect in regard to subsidence. (See *Appendix K, Subsidence Evaluation.*) The subsidence impacts evaluation calculates that maximum vertical displacement would be equal to the sum of the potential displacements from mining individual seams. The potential subsidence impacts to groundwater resources would essentially be the same as described for Alternative B due the great overburden thickness relative to the total mined thickness.

The expanded Iron Point Coal Lease area in Terror Creek is in a high potential subsidence area with overburden thickness of about 500 feet. Spring 5-2 is located in this area and could be impacted during mining operations.

It is believed that the B coal seam horizon is largely unsaturated in the Iron Point Lease Tract. As a result, active mine dewatering would not be necessary and there would be no associated impacts. Post-mine flooding of the B coal seam is not expected because this horizon is naturally unsaturated. No additional groundwater quantity or quality impacts are expected apart from those described for Alternative B.

Direct impacts for the Elk Creek Coal Lease Tract in Alternative C would be the same as described in Section 3.6.3.3, Effects of Alternative B.

3.6.3.5 Effects of Alternative D

Alternative D allows for multiple seam mining (B and D seams) in the Iron Point Coal Lease Tract but with special subsidence protection from impacts to Terror Creek, Hubbard Creek and the Curecanti-Rifle 230/345 kV electric transmission line. Extra precautions would be required to eliminate any subsidence impacts to Terror Creek and Hubbard Creek. Other direct impacts to groundwater resources in Alternative D would be less because Terror and Hubbard creeks would not be subsided. There would be no effects to shallow groundwater in the drainage bottoms.

3.6.4 Cumulative Impacts

Mining at the Sanborn Creek and West Elk mines is currently dewatering coal bearing zones in the Mesa Verde Formation. Mining in the Iron Point and Elk Creek Coal Lease tracts would continue to dewater the D coal seam zone of the Mesa Verde Formation. There may be a cumulative impact on water quality in the coal bearing zones of the Mesa Verde Formation. After mining ceases, mine voids would partially or completely fill with water and groundwater quality may be adversely impacted. This would add to water quality impacts from historic mines and when active mines are abandoned. It should be noted that the historic Hawks Nest and Oliver mines have had minimal impact to groundwater quality with elevated concentrations of TDS, iron, and manganese (Oxbow, 1999).

The effect on groundwater of increasing production on the Elk Creek Coal Lease Tract to 6 million tons per year would be minimal.

3.6.5 Potential Groundwater Mitigation and Monitoring

The mitigation and monitoring measures for groundwater quantity and quality are presented in *Table 3.6-4, Potential Mitigation and Monitoring Measures for Groundwater Resources.*

Table 3.6-4
Potential Mitigation and Monitoring Measures for Groundwater Resources

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
GW-1[3]	Potential impacts to springs and seeps water quantity and quality in the Iron Point Exploration License Area	No significant impacts are anticipated. However, it is recommended that a spring and seep inventory is conducted and identified spring sites be monitored for impacts.	1	Mining Company Colorado DMG
GW-2	Groundwater recharge reduction to the Hubbard Creek area.	Monitor for impacts. Supplement wetland and spring recharge to Hubbard Creek if needed.	1	Mining Company Colorado DMG
GW-3	Spring water quality impacts in the Hubbard Creek area.	Treat spring water discharge to meet appropriate water quality standards.	1	Mining Company Colorado DMG

Table 3.6-4
Potential Mitigation and Monitoring Measures for Groundwater Resources

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
GW-4	Baseline groundwater data and potential impacts to the groundwater system in the Hubbard Creek area of the Iron Point Coal Lease Tract	Install several monitoring wells on the west side of Hubbard Creek, prior to mining to better characterize and monitor changes to the groundwater system in the Hubbard Creek area.	1	Mining Company Colorado DMG OSM
GW-5	Groundwater inflows into mine workings.	Pressure grout the water-bearing fractures to stop or limit water inflow into the mine void.	1	Mining Company MSHA
GW-6	Baseline groundwater data and potential impacts to the groundwater system in the Elk Creek Coal Lease Tract	Complete a spring and seep inventory and establish a groundwater monitoring network including several wells and spring sites.	1	Mining Company Colorado DMG

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

GW-1 - A spring and seep inventory should be completed in any corridors of the Iron Point Exploration License Area that would have new roads and drill pads. Field water quality and flow measurements would be recorded at any identified spring site. After exploration activities are completed, the spring sites would be revised and any changes recorded.

GW-2 - Dewatering of the D coal seam during mining would impact groundwater flow and discharge in the Hubbard Creek drainage. This impact would be temporary and the coal horizon would recharge after mine dewatering ceases. At this time, no mitigation is anticipated for this impact. However, if monitoring indicates that mitigation is necessary to supplement wetland or stream recharge, the mining company may be able to pump water from the Blue Ribbon well and pipe water to affected areas or rechannel water from upper Hubbard Creek to the affected areas.

GW-3 - After mining is completed, the dewatered coal horizon would recharge with groundwater. The mine groundwater quality may be impacted, resulting in elevated TDS and dissolved constituents. If necessary, discharge of this water from springs in Hubbard Creek could be treated to meet appropriate water quality standards. Currently, mine water treatment at the Sanborn Creek Mine requires only settling of the TSS levels before discharge.

GW-4 - A monitoring network to include several monitoring wells installed in the D seam and adjacent strata and alluvium would be needed in the Hubbard Creek area of the Iron Point Coal Lease Tract. These wells should be located on the west side of Hubbard Creek across from the Blue Ribbon Mine. The wells would monitor the baseline groundwater levels and water quality in this zone prior to mining to monitor the potential effects of mine dewatering during mining, recharge after mining, and water quality changes. More consistent baseline data should be developed with year-round monitoring. It is also recommended that further hydrologic analysis be completed on Hubbard Creek to determine the interrelationship of ground and surface water and assess the potential for impacts due to mine dewatering. This would be expected to occur as part of the mine permitting process with the Colorado DMG.

GW-5 - Mining of the Iron Point and Elk Creek Coal leases may intercept saturated fractured rock zones. This could result in groundwater flow to the mine workings. If significant mine inflows are encountered at a fault or fractured rock zone, the mine operator would pressure grout the water-bearing fractures to stop or limit water inflow into the mine void. This type of mitigation would be required for mine safety and environmental concerns.

GW-6 - There is no monitoring network established in the Elk Creek Coal Lease Tract. If this tract were leased, the successful mining company would be required to conduct a spring and seep inventory and establish a baseline monitoring program. Data should be collected periodically year-round (monthly or quarterly). The monitoring network should include springs and monitoring wells. Wells would be needed in the D coal seam, and adjacent strata east of Hubbard Creek, in Bear Creek, and on the east side of the lease tract in Elk Creek. In addition, several alluvial wells should be installed in Hubbard, Bear, and Elk Creek drainages. It is anticipated that such additional hydrologic review would be part of the mine permitting process with the Colorado DMG.

3.7 VEGETATION

Issue: *Address the impacts to vegetation as a result of mining and exploration activity. Areas of concern include: the potential effects on threatened, endangered, or sensitive plants; control of noxious weeds; and, the impacts on vegetation as a result of any subsidence.*

3.7.1 Introduction

Existing Forest Service vegetation mapping and associated resource information was used as a foundation upon which to complete this vegetation baseline discussion. Project areas not covered by the existing mapping, including a small portion of Forest Service and BLM administered lands, along with privately-held property, were mapped at the reconnaissance level by the EIS team to complete vegetation survey coverage for this project. The vegetation communities used for the original Forest Service mapping were retained for this effort. Vegetation community discussions presented herein were developed as a result of the general data gathered during the reconnaissance survey and the soil survey completed for this area (Cryer and Hughes, 1997). Additional data sources are cited below as appropriate.

The potential presence of Forest Service and BLM listed sensitive species (Colorado BLM State Director's Office, 1999; GMUG 1999) were evaluated in light of species elevational and habitat requirements assembled by the Colorado Natural Heritage Program (Johnson, 1999; Spackman et al., 1997).

3.7.2 Affected Environment

3.7.2.1 Upland Plant Communities

Eight upland vegetation types were mapped at the reconnaissance level within the project area. See *Figure 21, Vegetation Map*. These types range from tree-dominated communities to those dominated by grass and forb species. A "Bare" designation was also included.

The Oak Vegetation Community is essentially ubiquitous across the project area occurring on ridge slopes, along ephemeral drainages, and over level to moderately rolling mountain meadows. Near pure stands of Gambel oak (*Quercus gambelii*) dominate drier ridge slopes. Where the community occurs in larger meadows and along drainages, it is more of a mixed shrub community composed of a wide variety of shrub species. This is a reflection of more mesic site conditions and wetter soil moisture regimes. The dominant shrub species is Gambel

oak. Other shrubs which can be co- or sub-dominant depending upon growing conditions include snowberry (*Symphoricarpos oreophilus* or *S. rotundifolius*) and serviceberry (*Amelanchier alnifolia*). Herbaceous species such as lupine (*Lupinus argenteus*), white-flowered peavine (*Lathyrus leucanthus*), and various upland sedge (*Carex*) species are common in the understory (Johnston, 1997). Chokecherry (*Prunus virginiana*) is also a common community component while small, sub-dominant aspen (*Populus tremuloides*) stands may become established in wetter areas where this community borders the aspen community.

Occurring across the project area over a variety of elevations and aspects is the Aspen Vegetation Type. This type inhabits less steep slopes overall than the other tree-dominated vegetation types on site, though its presence on somewhat steeper slopes under the proper soil conditions is not uncommon. It intergrades with most of the other vegetation types on site, excepting the Pinyon/Juniper, and characteristically has a more open, highly productive understory. The dominant tree species is aspen. Common understory species include Woods rose (*Rosa woodsii*), mountain brome (*Bromus marginatus*), elk sedge (*Carex geyeri*), white-flowered peavine, Fendler meadow-rue (*Thalictrum fendleri*), and American vetch (*Vicia americana*) (Johnston, 1997). Wetter expressions of this type, in depressions or adjacent to seeps and springs, often form transition wetland vegetation communities.

The Pinyon/Juniper Vegetation Community occurs on steep west and southwest-facing slopes at elevations typically below 7,000 feet. Dominant species include Utah juniper (*Juniperus osteosperma*) and Rocky Mountain juniper (*Juniperus scopulorum*) in the tree stratum. Pinyon pine (*Pinus edulus*) is also present. Dominant understory species include Gambel oak, mountain snowberry, Indian ricegrass (*Oryzopsis hymenoides*), and annual grasses (Western Resource Development Corporation, 1982). Rock outcrops are a major component of this unit. The soils are typically shallow and droughty compared to the soils supporting the other tree-dominated vegetation communities.

Steep to very steep canyon walls along Hubbard Creek and its tributaries support the Spruce/Fir Vegetation Community. Elevations nominally range from 6,800 to 8,000+ feet. This community tends to be comparatively dense and supported by soils reflecting more mesic conditions. Dominant tree species include Englemann spruce (*Picea engelmannii*), Colorado blue spruce (*Picea pungens*), and subalpine fir (*Abies lasiocarpa*) at higher elevations. Dominant understory species include bearberry (*Arctostaphylos uva-ursi*) and a variety of other shrubs and herbaceous species common to the Oak Vegetation Community but at lower densities. As with other vegetation communities dominating drainages, a comparatively narrow riparian zone including a small channel and associated wetland fringe is typically present. Rubble land is also common within this vegetation community.

The Douglas-fir Vegetation Community is found along the Terror, Hubbard, and Bear creek drainages at elevations around 7,000 feet or less where the narrow canyon drainages and rapid runoff potentials preclude the establishment of the Cottonwood Vegetation Community discussed below. This community may also be found growing on north-facing ridge slopes primarily bordering Bear Creek. The dominant tree species is Douglas-fir (*Pseudotsuga menzesii*). Common understory species include serviceberry, snowberry, oregon-grape (*Mahonia repens*), and heart-leaf arnica (*Arnica cordifolia*). This community can occasionally form broad transition zones, or ecotones, with the Spruce/Fir and Aspen communities resulting in more mixed vegetation types. The riparian areas common to the drainages of this community are similar to those of the Spruce/Fir type discussed above.

The Cottonwood Vegetation Community is limited to the south-central portions of Hubbard Creek at elevations below approximately 7,000 feet. Slopes are typically nearly level to level reflecting an overall wetter soil moisture regime as compared to the Douglas-fir and Spruce/Fir

vegetation communities located adjacent to drainages. Common tree species include narrow-leaf cottonwood (*Populus angustifolia*) and box-elder (*Acer negundo*) with Douglas-fir, Englemann spruce, and juniper species occurring on side-slopes under drier soil moisture conditions. Aspen may also be present in topographic depressions or in deeper, more fertile soils. Understory shrub species include those adapted to more moist substrates such as chokecherry, raspberry (*Rubus idaeus*), and Woods rose. As a consequence of more level topography and decreased runoff potentials, the wetlands and Waters of the U.S. associated with this vegetation community are broader and more well developed as compared to drainages in other vègetation communities.

Scattered across the project area, the Grass/Forb Vegetation Community is associated primarily with nearly level to moderately sloping sites on a variety of aspects. Similarly, Elevations vary in a similar manner. This community occurs as small natural clearings within other vegetation types, revegetated development disturbances, and heavily grazed meadows often associated with developed stockponds. Dominant vegetation includes a variety of native and introduced herbaceous species depending upon the origin of each delineation. Native species present include wheatgrasses *(Agropyron* sp.), bluegrasses (*Poa* sp.), needlegrasses (*Stipa* sp.), and a variety of penstemons (*Penstemon* sp.), as well as rushes (*Juncus* sp.) and spikerushes (*Eleocharis* sp.) bordering stock pond margins. Introduced species present, depending upon the disturbed site, include smooth brome (*Bromus inermis*), crested wheatgrass (*Agropyron desertorum*), Kentucky bluegrass (*Poa pratensis*), and alfalfa (*Medicago sativa*) along with a number of introduced weedy species at varying densities (Hayes Environmental Services, Inc., 1995).

The “Bare” cover designation includes rock slides, steep-walled cliffs, and other areas which support little or no vegetation due to the surface expression of geologic material. Bare areas are also associated with the boundaries of the Terror Creek Reservoir. These areas total a comparatively small acreage.

3.7.2.2 Noxious Weeds

A number of noxious weed species are known to be of concern with respect to the project area in Delta and Gunnison counties. These species include, but are not limited to, Russian knapweed (*Centaurea repens*), hoary cress (*Cardaria draba*), yellow toadflax (*Linaria vulgaris*), Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), and scotch thistle (*Onopordum acanthium*) (Calicut, 1999; Green, 1999). Typically, these species are aggressive and highly competitive with more desirable species. Species such as scotch and musk thistle, along with Russian knapweed, form dense colonies which may be difficult to eradicate.

Noxious weeds are prone to establishment on newly disturbed sites. County regulations require that these species must be controlled where they become newly established.

3.7.2.3 Threatened and Endangered Plant Species

One federally listed threatened and one endangered plant species occur in the region within which the project area is located. The Uinta Basin hookless cactus (*Sclerocactus glaucus*), a threatened species, occurs at elevations ranging from 4,500 to 6,000 feet on rocky hills, mesa slopes, alluvial benches, and in desert shrub communities. Listed as an endangered species, clay-loving wild buckwheat (*Eriogonum pelinophilum*) inhabits Mancos shale badlands in salt desert shrub communities at elevations ranging from 5,200-6,400 feet. Both have been found previously in Delta County. As was noted for the environmental assessments prepared previously for the lease tracts, no suitable habitat for these species occurs on either proposed lease area, or the exploration license area. Further, the elevation ranges within which these

species are known to occur are, for the most part, below the lowest elevation found on the project area. These species would not be affected by the proposed leasing, mining, or exploration activities.

3.7.2.4 Sensitive Plant Species

Nine "forest sensitive" species are listed as potentially occurring on the GMUG, and Gunnison National Forests (GMUG, 1999). An additional 11 sensitive species are listed as potentially present on BLM lands administered by the BLM Uncompahgre Field Office (Colorado BLM State Director's Office, 1999). *Table 3.7-1, Sensitive Plant Species Summary*, presents a combined list of these species along with selected information concerning these species' habitat requirements, elevational ranges, and known presence in Delta and Gunnison counties (Ferguson, 1999; Johnson, 1999; LaFevere. 1999; Spackman et al., 1997).

The proposed project area ranges in elevation from 6,400 feet to approximately 8,500 feet. Six of the 20 listed species are adapted to habitat types occurring at elevations ranging from 8,500 to 14,000 feet, above the highest elevation of the proposed project area. In several cases, these species also occur in alpine habitat types such as peat mats, acidic ponds, fens, and alpine scree which are comparatively unique to higher elevations. The species in this category include molybdenum milkvetch *(Astragalus molybdenus*), smooth rockress (*Braya glabella*), round-leaf sundew (*Drosera rotundifolia*), wooly fleabane (*Erigeron lanatus*), white-bristle cotton-grass (*Euphorum altaicum*), and Colorado tansy-aster (*Machaeranthera coloradoensis*). Sandstone milkvetch (*A. sesquiflorus*), Dolores skeletonplant (*Lygodesmia doloresensis*), Eastwood monkey-flower (*Mimulus eastwoodiae*), and Paradox breadroot (*Pediomelum aromaticum*) are all known to occur at elevations lower than that of the project area and in habitats not present on the proposed lease tracts or exploration license areas.

Three species, including the Grand Junction milkvetch (*A. linifolius*), Colorado desert parsley (*Lomatium coccinium*), and the Paradox Valley lupine (*Lupinus crassus*) are typically supported by soils derived from the Mancos, Chinle, and/or the Morrison geologic formations. These formations do not outcrop in or overlie the project area. In addition, the milkvetch and lupine are typically found at elevations lower than those characteristic of the project area. The Gunnison milkvetch (*A. anisus*) inhabits elevations common to the project area but is associated with dry or sandy clay soils underlain by granitic bedrock supporting low sagebrush (*Artemisia arbuscula*) vegetation communities. Neither surficial granitic bedrock nor low sagebrush is known to be present within the project area boundaries. Similarly, the lack of barren gray shales or adobe hills on site eliminates the concern for the Rocky Mountain thistle (*Cirsium perplexans*).

Naturita milkvetch (*A. naturitensis*), San Rafael milkvetch (*A. rafaelensis*), Montrose bladderpod (*Lesquerella vicina*), and Beard-tongue gilia (*Gilia penstemonoides*) occur at elevations and in habitats similar, at least in part, to those of the project area. However, the project area is well out of the known ranges of these species.

Hapman's coolwort (*Sullivantia hapemanii*) exhibits a preference for a habitat type which could be present at Hubbard Falls located in the SW¼, Section 14, T12S, R91W. Therefore, this species could be present in the northernmost portion of the project area.

Table 3.7-1
Sensitive Plant Species Summary

Species Name	Agency Listing	Code[1]	Elevation Range (feet)	Habitat Characteristics	Known in Delta/Gunnison Counties	Potentially Present in Project Area
Gunnison milkvetch *Asragalus anisus*	USFS	FS	7,500-8,500	Dry or sandy clay soils, under low sagebrush	No/Yes	No
Grand Junction milkvetch *A. linifolius*	BLM	SS	4,800-6,200	Chinle and Morrison geologic formations	Yes/No	No
Molybdenum milkvetch *A. molybdenus*	USFS	FS	11,400-13,200	Rocky slopes, turf hillsides	No/Yes	No
Naturita milkvetch *A. naturitensis*	BLM	SS	5,000-7,000	Sandstone mesas in pinyon-juniper woods	No/No	No
San Rafael milkvetch *A. rafaelensis*	BLM	SS	4,400-6,500	Hills, washes, talus; in seleniferous soils	No/No	No
Sandstone milkvetch *A. sesquiflorus*	BLM	SS	5,000-5,500	Sandstone ledges, talus and sandy washes	No/No	No
Smooth rockress *Bray glabella*	USFS	FS	12,000-13,000	Calcareous substrates above timberline	No/Yes	No
Rocky Mountain thistle *Cirsium perplexans*	BLM	SS	4,500-7,000	Barren gray shale; adobe hills	Yes/No	No
Round-leaf sundew *Drosera rotundifolia*	USFS	FS	9,100-9,800	Peat mats, acidic ponds and fens	No/Yes	No
Wooly fleabane *Erigeron lanatus*	USFS	FS	12,500-13,500	Steep alpine scree, talus slopes	No/Yes	No
White-bristle cotton grass *Eriophorum altaicum*	USFS	FS	9,500-14,000	Fens	No/Yes	No
Beard-tongue gila *Gilia penstemonoides*	USFS	FS	6,800-9,000	Walls, ledges, cliffs in gneiss, schist, shale	No/Yes	No
Montrose bladderpod *Lesquerella vicina*	BLM	SS	6,000-7,200	Mancos shale, also sandstone soils, sagebrush step; disturbances	No/No	No

Table 3.7-1
Sensitive Plant Species Summary

Species Name	Agency Listing	Code[1]	Elevation Range (feet)	Habitat Characteristics	Known In Delta/Gunnison Counties	Potentially Present in Project Area
Colorado desert parsley *Lomatium cocinnum*	BLM	SS	5,500-7,000	Rocky soils from Mancos shale; shrub communities	Yes/No	No
Paradox Valley lupine *Lupinus crassus*	BLM	SS	5,000-5,800	Chinle and Mancos geologic formations; sparse vegetation	No/No	No
Dolores skeleton plant *Lygodesmia doloresensis*	BLM	SS	4,400-4,700	Red alluvial soil in juniper grasslands	No/No	No
Colorado tansy-aster *Machaeranthera coloradoensis*	USFS	FS	8,500-12,500	Gravelly parks, slopes, rock outcrops up to dry tundra	No/Yes	No
Eastwood monkey-flower *Mimulus eastwoodiae*	BLM	SS	4,700-5,800	Shallow caves and seeps on canyon walls	Yes/No	No
Paradox breadroot *Pediomelum aromaticum*	BLM	SS	4,000-5,000	Red clay, clay outcrops, rocky soil, rock outcrops	No/No	No
Hapman's coolwort *Sullivantia hapemanii*	USFS	FS	7,000-10,000	Hanging gardens, wet cliffs, boulders in limestone and shale	No/Yes	Yes

Note: 1. FS=Forest Sensitive (U.S. Forest Service) SS=Sensitive Species (BLM)

Adapted from: Colorado BLM State Directors Office 1999, Ferguson 1999, GMUG 1999, Johnson 1999, Spackman et al. 1997

3.7.2.5 Forest Resources

That portion of the forest within which the project area lies has not been subject to intensive logging or forest management practices. Most desirable timber species occur on slopes too steep or are located in drainages too narrow for efficient logging to occur. Typically, slopes over 40 percent are not subject to commercial logging (Jones, 1999a).

From 1980 through 1999 there have been several timber sales to the west and north of the Iron Point Coal Lease Tract and exploration area. These sales affected approximately 400 acres within the Hubbard and Terror Creek drainages between 1980 through 1989 and 973 acres between 1990 through 1999. The Forest Service expects that small timber sales would occur in the future.

3.7.2.6 Range Resources

All or portions of seven federal grazing allotments occur within the lease tracts and exploration area. *Table 3.7-2, Summary of Forest Service and BLM Grazing Allotments,* depicts selected information related to these allotments. Stock for which these allotments are set aside include both cattle and sheep. Season of use typically ranges from late June to late September/early October on Forest Service managed land. Season of use on BLM managed land is more variable typically ranging from early spring to late spring through late fall (Jones, 1999b, 1999c).

3.7.3 Environmental Consequences

The construction of various borehole, shaft, and access road facilities would directly affect a maximum of approximately 33.5 acres of vegetation. The primary vegetation communities to be affected include the Oak and Aspen Vegetation types. The resulting loss of both timber and grazing resources is minimal, with the potential for a slight long-term increase in grazing potential possible following revegetation activities. No threatened or endangered plant species occur on site given these species' habitat requirements.

Table 3.7-2
Summary of Forest Service and BLM Grazing Allotments

Name	Agency Listing	Number	Dates of Use	Stock Type	Animal Unit Months (AUMs) or Ewe/Lamb Pairs
Coal Gulch	BLM	14517	5/15-7/1	Sheep	587 AUMs
Hubbard Creek	BLM	14516	5/10-6/10	Sheep	45 AUMs
Stevens Gulch Common	BLM	14513	10/1-5 6/1-25	Cattle	73 AUMs
Upper Terror Creek	BLM	14514	6/1-9/30	Cattle	59 AUMs
Condemn-It Park S&G	USFS	NA	6/20-9/20	Sheep	1,000 ewe/lamb pairs
East Terror C&H	USFS	NA	6/26-10/5	Cattle	500 cow/calf pairs
Hotchkiss S&G	USFS	NA	6/21-9/20	Sheep	1,840 ewe/lamb pairs

3.7.3.1 Effects of Alternative A (No-Action)

Vegetation communities of the project area would continue to be subject to low levels of use in the form of grazing and other incidental activities such as firewood harvesting. No direct or indirect affects associated with the reasonable foreseeable actions listed for either the coal lease tracts or the exploration license area are anticipated. Future impacts to vegetation would parallel historic impacts barring any unforeseen developments or changes in land use policies. Endemic vegetation communities would continue to mature at natural rates while previously disturbed areas would be revegetated through time.

3.7.3.2 Effects Common to All Alternatives

Direct Effects - A total of 33.5 acres is proposed to be disturbed by borehole, shaft, and access road construction under all action alternatives. The proposed locations of the exploration boreholes on the exploration license area are shown on *Figure 4, Iron Point Exploration Plan*. Eighteen boreholes (4.5 acres) are located in the Oak Vegetation Community, five (1.25 acres) in the Aspen Vegetation Community, two (0.5 acres) in the Grass/Forb Vegetation Community, and one (0.25 acres) would be located in either the Douglas-fir or Cottonwood Vegetation Community. The locations of the degasification boreholes (6.0 acres), exhaust shafts (3.0 acres), ventilation shafts (1.0 acre), and access roads (17.0 acres) are not known specifically. For the purposes of this section, it is assumed that the vegetation communities impacted by construction of the latter facilities would be proportionately the same as for the exploration boreholes, with minor impacts to the Spruce/Fir Vegetation Community factored in.

No federal timber sales are planned for the project area within the next 10 years. This is due, in part, to the characteristics of tree stands existing and the topography over which they have become established. Most of the timber stands are considered unsuitable for timber harvest due to steep slopes, and low volumes per acre. However, the value of the timber resource which would be impacted by facility construction can still be estimated. Given standard values for aspen and spruce/fir timber (Jones, 1999a), and assuming that the values of cottonwood and Douglas-fir timber are similar, the value of the forest resource lost by clearing for subsequent facility construction could be approximately $4,300.

In terms of the range resources of the lease and exploration areas, the temporary clearing of 33.5 acres equals a loss estimated to be approximately 2.0 (cow/calf pair) animal unit months (AUMs) out of a total exceeding 500 AUMs (Jones, 1999b, 1999c). This temporary negative impact would be offset by a longer term positive impact following revegetation when, by reseeding the disturbed areas with grass species, the disturbed sites would be returned to a somewhat higher grazing value. Overall, however, both the positive and negative impacts are considered to be negligible given the comparative size of the area involved.

Weed infestations could occur in areas disturbed by the construction of various boreholes, shafts, and access roads. While it is uncertain whether this would take place, it is reasonable to assume that the potential exists given the natural invasive tendencies of these aggressive species whether by natural or man-induced vectors. The scattered nature of the proposed disturbances across the lease area give rise to further concerns with respect to the spread of these species over areas larger than the initial 33.5 acres to be disturbed. The mining plans summarized in Chapter 2.0, Alternatives Including the Proposed Action, do address this issue but do not include the development of a weed control plan to be submitted to the appropriate Delta and Gunnison County agencies. Mitigation is proposed to address this concern. The Forest Service requires that any reseeding be completed using a certified, weed-free source. No threatened or endangered species present within the region are believed to occur within the

project area due to these species' elevational and habitat requirements. Similarly, 19 of the 20 species listed as sensitive and occurring within the region by either the BLM or the Forest Service are believed to be absent from the project area for these same reasons. The presence or absence of Hapman's coolwort at Hubbard Falls should be documented in light of the potential effects from subsidence. Mitigation is proposed to address the question of whether this species exists on site and what future mitigation actions might be appropriate if it does.

Indirect Effects - Indirect effects are discussed individually for each alternative below.

3.7.3.3 Effects of Alternative B

Direct impacts to the vegetation resource are generally consistent across all alternatives. There is a potential to impact Hapman's coolwort at Hubbard Falls if subsidence occurs in this area. As noted in Section 3.4, Soils, the effect of subsidence would manifest itself as cracks forming on the earth's surface followed by a settling of the ground elevation as the geologic strata cave, at depth, behind the retreating longwall operation. Some cracks, devoid of vegetation, would remain on the surface at the conclusion of mining. The vegetation acreage which would be affected by cracking cannot be calculated but would likely be minimal considering the potential acreage involved and the natural ability of these cracks to revegetate. It is unlikely that a measurable acreage of vegetation would be lost given these considerations.

3.7.3.4 Effects of Alternative C

The affects of subsidence under this alternative would be the same as for Alternative B except for the effects related to the adoption of multi-seam mining activities and the increased lease acreage involved. With multi-seam mining, the depth to which geologic strata cave behind the advancing mining operation is greater. Given that the lease area under Alternative C is approximately 10 percent greater than under Alternative B, a comparatively larger acreage could be subject to the effects of subsidence.

3.7.3.5 Effects of Alternative D

Alternative D is identical to Alternative C except that special subsidence protection would be required under specific features such as Terror Creek, Hubbard Creek, the Curecanti-Rifle 230/345 kV electric transmission line. As a result, the affects on the vegetation communities extant would be the same only over a slightly smaller lease area. The affects of subsidence would still be greater under this alternative as compared to Alternative B.

Hapman's coolwort could be present at Hubbard Falls. Given the restrictions of mining within and beneath perennial streams on site, it is unlikely that this species or its habitat, if present, would be subject to any direct effects from underground mining.

3.7.4 Cumulative Impacts

Approximately 33.5 acres of vegetation may be affected by surface disturbances on the lease and exploration areas. Seventy acres of previous disturbances are associated with the existing Bowie No. 2 Mine and approximately 95 acres have been disturbed at the Sanborn Creek Mine. Approximately 10 to15 acres and 15 acres of additional disturbances are planned at these two mining operations, respectively. It is also estimated that about 150 acres have been disturbed by operations at the West Elk Mine to the south. The acreage of vegetation proposed to be directly affected within the cumulative affects area, by any alternative under consideration, represents an increase in disturbed area of approximately 10 percent. With respect to the total acreage of the project area, the proposed disturbances equal less than 1 percent of the total

acres involved. The acreage affected by subsidence would not increase these totals measurably.

The effect on vegetation of increasing production on the Elk Creek Coal Lease Tract to 6 million tons per year would be minimal.

3.7.5 Potential Vegetation Mitigation and Monitoring

Mitigation and monitoring measures for vegetation are set forth in *Table 3.7-3, Potential Mitigation and Monitoring Measures for Vegetation.*

Table 3.7-3
Potential Mitigation and Monitoring Measures for Vegetation

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
V-1[3]	The establishment and spread of identified noxious weeds	Prepare a weed control plan for submittal to Delta and Gunnison county governments	1-2	Colorado DMG
V-2	Assessing the potential presence of, and potential impacts to, Hapman's coolwort	Conduct a survey of Hubbard Falls to determine if Hapman's coolwort is present. Prepare the appropriate reports	1	Mining Company Forest Service
V-3	Prevent spread of noxious weeds	Use certified weed free source of seed for revegetation activities	1-2	BLM Forest Service

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

V-1 - Develop a weed control plan, addressing Delta and Gunnison County requirements, which would be employed to control the establishment and spread of identified noxious weeds. The plan should include the control of weeds during and following the cessation of mining operations and include such measures specifying the use of certified weed free seed and mulch products.

This mitigation would be effective, if followed during operations, in reducing the potential for weed invasions over the lease and exploration areas.

V-2 - Conduct a survey of Hubbard Falls during June-July of 2000 to determine if Hapman's coolwort is present at this site. If present, develop a monitoring plan and, if necessary, a mitigation plan acceptable to the Forest Service for avoiding impacts to this species. This measure would be highly effective in achieving the stated goal of the measure and in increasing the potential for protecting this species if it exists on site.

V-3 - The use of a certified weed-free source of seed for revegetation would be effective in preventing the spread of noxious weeds.

3.8 WETLANDS

Issue: *Identify and minimize impacts to wetlands and Waters of the U.S. Areas of concern include: the acres of wetlands lost through direct impact; the changes in functions of values and wetlands and riparian areas as a result of mining and exploration activities; and, the potential effects from subsidence on these areas.*

3.8.1 Introduction

No formal delineations of wetlands or other Waters of the U.S. have been completed on either coal lease tract or the exploration license area. Seep and spring information was completed for the lease tracts and the exploration license area, but no wetlands data was collected. A formal wetlands delineation was completed for the proposed Elk Creek Mine portal location on private (fee) land.

To complete this section, a reconnaissance of readily accessible sites on, and bordering, the project area was made to record the essential characteristics of wetlands and other Waters of the U.S. typical of the lease tracts and exploration license area. These reconnaissance efforts were completed May 27 and June 18 and 19, 1999. The wetland delineation report completed for the portal area in June 1999 was also reviewed to support this section.

A more detailed analysis of the physical characteristics of seeps and springs can be found in Section 3.6, Groundwater.

3.8.2 Affected Environment

3.8.2.1 Wetlands

Wetland plant communities, other than those associated with seeps, springs, and stockponds, are typically confined to the borders of creeks and drainage channels. The soils of the wetlands located in the major drainage channels may exhibit light-colored matrices with little evidence of hydric indicators due to the continuous flooding and scouring typical of such channel gradients. Conversely, soils of the drainage channels having more gentle gradients are darker in color with chromas of less than 2 being common. Wetland hydrology is provided by channel flooding, lateral flow, and subirrigation. Wetland/upland transition zones are typically narrow to abrupt as a function of channel topography, though broad transition zones can be found in more gently sloping areas.

Wetland vegetation communities are comparatively simplistic in terms of diversity, typically being dominated by a few hydric species. The tree stratum, where it occurs, is dominated by narrow-leaf cottonwood (*Populus angustifolia*) and boxelder (*Acer negundo*) at lower elevations. Aspen (*Populus tremuloides*) is the common tree of wetlands occurring at higher elevations. Shrub species are essentially ubiquitous across the majority of the wetlands associated with creeks and drainage channels, although some small drainages located between narrowly spaced ridges do not support a shrub canopy. Dominant wetland shrubs include a variety of willows such as coyote willow (*Salix exigua*) and plane-leaf willow (*Salix planifolia*), thinleaf alder (*Alnus tenuifolia*), and red-osier dogwood (*Cornus stolonifera*). Wetlands typically include a mix of these species although large, dense stands of willows or dogwood may be found in the more gently sloping floodplains of Hubbard Creek.

Herbaceous species occurring within these wetlands are variable and have become established in direct response to soil/hydrologic conditions reflecting soil depth, water holding capacity, and period of saturation. Along drainages where sandy soils and comparatively steep gradients

predominate, few herbaceous species have become established to any degree. Wetland shrubs are the primary community component. Conversely, in more gently sloping drainages where soils have developed more fully and organic matter has accumulated, herbaceous species such as cow parsnip (*Heracleum lanata*), false Solomons-seal (*Smilacina stellata*), California false-helebore (*Veratrim californicum*), northwest cinquefoil (*Potentilla gracilis*), and a variety of sedge (*Carex*) and rush (*Juncus*) species have become established.

3.8.2.2 Other Waters of the U. S.

Drainage Channels - The major drainages of the project area are characterized by straight to curved channel beds. Braided formations and meanders are rare. The beds and banks are well developed and have formed in response to topographic gradients. These drainages exhibit gravel/cobble beds. Channel fines are typically sand-size. Smaller drainages in the project area have less well-defined beds and banks and are often vegetated to the channel borders. These channel beds often have a higher percentage of fines mixed with endemic gravels and cobbles.

Seeps, Springs, and Stockponds - These three features are common across the project area. Seeps and springs are naturally occurring and are primarily associated with coal seam outcrops at lower elevations and with sandstone lenses and colluvial/landslide deposits at higher elevations. They are more common at higher elevations and may exhibit seasonal or perennial flows. Recharge comes from direct precipitation or snowmelt infiltration. Seeps and springs on steeper slopes typically support vegetation communities dominated by willows along with a variety of grasses and forbs. Seeps and springs on nearly level to moderate terrain, particularly at higher elevations, support herbaceous communities dominated by such species as California false-hellebore, streamside bluebells (*Mertensia ciliata*), and various sedge species. A wetland shrub component may be conspicuously lacking at the higher elevations due in some cases to the dense, competitive herbaceous stratum. Aspen typically provides a tree component where one exists, though this species is not a consistent indicator of wetland seep or spring conditions.

Stockponds are man-made features which are filled either by flow from springs or overland runoff. Wetlands occurring in association with developed stockponds are typically limited to a narrow bank fringe, though more extensive wetlands may develop in the drainages leading to stock pond depressions. The wetland fringe is dominated primarily by spikerush (*Eleocharis*) and rush (*Juncus*) species. Other species such as small-winged sedge (*Carex microptera*), clustered field sedge (*Carex praegracilis*), northwest cinquefoil and a variety of butter-cups (*Ranunculus* sp.) may also be present. A wetland shrub or tree stratum is rare, presumably as a direct result of animal use and/or soil compaction from earthwork by dozers or other equipment.

3.8.2.3 Riparian Zones

Riparian zones occur along project area drainages and are characterized by comparatively narrow vegetation communities requiring wetter soil hydrologic conditions than the surrounding uplands. The boundaries of riparian zones are limited in width by the steep topography associated with drainage systems. These zones may or may not include a recognized wetland component. A variety of tree species are usually associated with the riparian zones of the project area and, where occurring, the shrub component is denser than in the surrounding uplands due to soil moisture conditions. Recent studies in the semiarid west comparing riparian areas with adjacent uplands showed that riparian zones support up to 400 percent more plant biomass, up to 200 percent more species richness, and contribute to large increases in density and species richness for birds when compared with upland areas (Clary and Medin, 1998).

Douglas-fir (*Pseudotsuga menzesii*) dominates the drier portions of the riparian zone at lower elevations. Utah juniper (*Juniperus osteosperma*) and Rocky Mountain juniper (*Juniperus scopulorum*) also occur on drier sideslopes along with shrubs such as Gambel oak (*Quercus gambelii*), snowberry (*Symphoricarpos oreophilus*), serviceberry (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), and red-osier dogwood. In more moist situations, tree species such as boxelder and narrow-leaf cottonwood are present. A spruce/fir community is common to riparian zones of higher elevations. This community is characterized by Englemann spruce (*Picea englemannii*) and Colorado blue spruce (*Picea pungens*). Understory shrub components are similar to those of lower elevations, though species such as Woods rose (*Rosa woodsii*) and thinleaf alder are somewhat more prevalent. Aspen becomes a co-dominant tree species as elevation increases and is the dominant species in wetter zones of the higher elevations.

The herbaceous understory of the riparian zone is highly variable where upland species dominate. Where wetlands occur within this zone, the species present parallel those discussed in Section 3.8.2.1, Wetlands.

3.8.3 Environmental Consequences

The following text presents a discussion of potential impacts to the wetlands/riparian areas located within the project area. The impacts identified are those which can be expected to occur as a result of the proposed activities and alternatives detailed in Chapter 2.0, Alternatives Including the Proposed Action. Direct impacts include those associated with land clearing and grading to develop exploration and degasification boreholes, ventilation and exhaust shafts, and access roads. Indirect impacts, which vary by action alternative, are directly associated with potential subsidence dewatering in Hubbard and Terror creeks.

3.8.3.1 Effects of Alternative A (No-Action)

Wetlands would not be affected by the reasonable foreseeable actions listed for either lease area or the exploration license area under the No-Action Alternative. These resources would continue to exist in their endemic state, subject to natural variability and the limited affects of incidental human use. It is anticipated that wetland form and function characteristics would remain essentially constant. Some surficial impacts associated with grazing and limited logging are expected.

3.8.3.2 Direct Effects Common to All Alternatives

Direct Effects - Twelve of the 26 proposed exploration borehole sites were visited during the opening phases of this project. See *Figure 4, Iron Point Exploration Plan*. Forest Service stipulations preclude siting any drill hole in wetland/riparian areas. Wetland avoidance is a positive approach to siting borehole or shaft disturbances given grading and drilling requirements as well as regulatory concerns. Specific clearance would be required if a borehole was sited in a wetland/riparian area. Should wetlands be disturbed in this manner, impacts would include vegetation clearing along with hydric soil removal and stockpiling. If fed by surface runoff, the potential hydrologic regime of the impacted wetland would not likely be affected. If, however, the wetland was supported by a groundwater source, this source could be negatively impacted by grading depending upon the required depth of excavation.

Approximately 17 acres of access roads could be constructed or upgraded as a part of the proposed exploration or mining-related activities. Stipulations would require placing roads outside wetland/riparian areas. As with proposed borehole and shaft disturbances, wetlands would be avoided where possible. It can be reasonably assumed, however, that a small portion of the road acreage to be constructed or upgraded would occur along, or unavoidably intersect,

project area wetlands. Isolated wetlands out of stream channels would be impacted in much the same manner as for borehole and shaft development. Wetlands along stream channels, as well as the channels themselves, would be subject to limited grading sufficient to enable vehicle access. Such grading would likely eliminate or modify a small area of wetlands within and immediately bordering the road right-of-way. To some degree it would also disturb the non-vegetated bed and bank associated with the stream. (Examples of these types of impacts currently exist within the project area.) It can be assumed that these impacts would occur along the major drainages such as Hubbard, Bear, and Terror creeks given the comparative size of these drainages.

The extent of these potential impacts cannot be assessed given the lack of wetland baseline data and the fact that some of the borehole, shaft, and access road locations are not known. The impacts would be limited, however, given the propensity to avoid wetland sites in light of construction limitations and regulatory requirements. Reclamation following facility and road decommissioning would render these impacts short-term and mitigable given the adoption of a suitable wetland mitigation plan. Mitigation measures are proposed in Section 3.8.5, Potential Wetlands Mitigation and Monitoring, to address the lack of data and the inability to quantify these wetland impacts.

Indirect Effects - Indirect impacts are discussed below, individually for each alternative.

3.8.3.3 Effects of Alternative B

The proposed construction of boreholes, shafts, and roads follow plans that are the same for Alternatives B, C, and D. Therefore, direct impacts to wetlands are identical across all action alternatives. The impacts that vary by alternative are the indirect impacts associated with the surface and near surface effects of subsidence.

Subsidence associated with longwall operations results in a “cracking” of the soil surface above the retreating longwall operation as well as a caving, fracturing, and deformation of geologic strata between the surface and the coal seam being mined. Caving and fracturing occur in an ascending sequence immediately above the mined coal seam. Strata deformation occurs transitionally above the comparatively thin fractured zone and extends to the surface. While each of these effects could impact seeps and springs (and the stockponds and wetlands they support), coal removal, caving, and fracturing at greater depths are likely to have the greatest impacts on these resources. As coal is removed, caving and fracturing occur, and the geologic strata immediately above the coal seam bearing the groundwater and giving rise to seeps and springs is disrupted. With disruption, there is a high potential, especially where coal removal and caving occurs, to modify or eliminate the water sources supporting these features resulting in a drying impact to wetlands. See Groundwater Sections 3.6.3.2, Effects Common to All Action Alternatives, and 3.6.3.3, Effects of Alternative B.

Figure 14, Subsidence Potential Map, depicts zones showing the potential for subsidence affects rated from “very low” to “very high” based on overburden depth and the presence of geologic hazards. As can be seen, the potential affects of subsidence are inversely proportional to overburden depth. Approximately 20 seeps and springs are located in zones for which the potential for subsidence is considered to be high to very high. The seeps and springs within the zone of coal removal, caving and fracturing have a reasonable potential for being modified in some way, or eliminated, by subsidence.

With dewatering of the coal seam during operations, wetlands along Hubbard Creek may be affected, either in size, form, and/or function due to a reduction of seep and spring flow that contribute to these wetlands. This alternative assumes subsidence of Hubbard and Terror

creeks. Section 3.5, Surface Water Hydrology, indicates that the creeks may be dewatered due to mining. Any loss of flow in the creeks would affect the wetland and riparian vegetation in the stream bottoms. Water loss could reduce the size, form and function of the existing wetlands and riparian areas and the associated habitats. Seep and spring contributions to Hubbard Creek near the subcrop of the D coal seam may be reduced by an estimated less than 1 to 14 percent per year by mine dewatering depending upon annual stream flow volumes. A reduction of less than 1 percent would not likely result in a measurable effect to the wetlands within the drainage. No impacts would be expected to the shrub or tree strata given that these comparatively deep-rooted species are well established in the drainage. Some changes in composition of the herbaceous strata could occur, but would not likely be discernable.

A flow reduction of 14 percent could have a measurable effect on the Hubbard Creek wetlands/riparian areas. The wetland/riparian and boundary zone would likely shrink along the margins of the drainage. Dominant wetland herbaceous species inhabiting this zone and requiring saturated soils throughout the growing season would likely be replaced, in part, by wetland or upland plants adapted to less hydric soil moisture regimes. Recruitment of wetland shrub and tree species, particularly willows (*Salix sp.*), would likely cease, at least in part, and plant growth be curtailed somewhat. Established tall shrubs and trees along the drainage margins and on the higher alluvial bars would typically weather these conditions for the first few growing seasons and then begin to be affected depending upon the length of time that these conditions prevailed.

Following cessation of underground mining activities, the abandoned workings would fill with water and be expected to recover to the approximate conditions that existed prior to mining. When this occurs, pre-mining seep and spring conditions would be expected to return to Hubbard Creek near the vicinity of the D coal seam subcrop. Wetlands along Hubbard Creek would likely return to their pre-mining form and function.

3.8.3.4 Effects of Alternative C

The affects of subsidence under this alternative would be the same as Alternative B except that the adoption of multi-seam mining activities and the increased area to be mined would create greater impacts. With multi-seam mining, the thickness of geologic strata subject to caving and fracturing behind the retreating mining operation is somewhat greater. Therefore, the potential is greater in Alternative C than in Alternatives B and D to affect more seeps, springs, stockponds and their dependent wetlands.

3.8.3.5 Effects of Alternative D

Alternative D is identical to Alternative C except that special subsidence protection would ~~not~~ be required under specific features such as Terror Creek, Hubbard Creek, and the Curecanti-Rifle 230/345 kV electric transmission line. The potential effects of subsidence would be the same as for Alternative C except that there would be less risk to the wetland/riparian areas in Terror Creek. The number of seeps and springs potentially to be affected could also be somewhat less.

3.8.4 Cumulative Impacts

The total acreage of wetlands disturbed previously by mining and other activities within the cumulative affects area is unknown. No wetland delineations are known to exist which would cover the existing mining disturbances, in total. Seep and spring surveys competed for the exploration and lease areas did not include the collection of typical wetland vegetation data. Past exploration, shaft and borehole drilling, portal construction, and general access road

development activities could have impacted wetlands to an unknown, but limited degree on existing permitted mine areas.

Given the lack of information regarding past impacts to wetlands and the fact that no comprehensive wetland studies have been completed for the project area, cumulative impacts to the wetland resources cannot be calculated. It can be assumed that the exploration, drilling, and road construction activities proposed would affect these resources in a manner proportionate to the acreage affected by past operations. The indirect affects of subsidence on wetland resources, in the form of seeps and springs, are similarly unquantifiable with respect to cumulative affects.

Bowie has been issued a General Permit No. 21 by the U.S. Army Corps of Engineers to construct two sediment ponds and a portion of a road in association with the Bowie No. 2 Mine. The total disturbance, including both wetlands and other Waters of the U.S., is limited to 0.33 acres. This disturbance will be mitigated at a 1 wetland acre disturbed : 1 wetland acre created ratio.

Oxbow has been issued a General Permit No. 21 by the Corps of Engineers for the proposed portal construction in Elk Creek. This permit was issued on July 28, 1999.

The effect on wetlands of increasing production on the Elk Creek Coal Lease Tract to 6 million tons per year would be minimal.

3.8.5 Potential Wetlands Mitigation and Monitoring

The mitigation and monitoring measures for wetlands are set forth in *Table 3.8-1, Potential Mitigation and Monitoring Measures for Wetlands.*

Table 3.8-1
Potential Mitigation and Monitoring Measures for Wetlands

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
W-1[3]	Disturbances to wetlands and waters of the U.S.	Complete a delineation survey, and follow-up permitting and mitigation planning as necessary, for wetlands and Other Waters of the U.S. within the project area.	1	Mining Company Army Corps of Engineers
W-2	Loss of seep, spring, and stockpond values and functions.	Complete a survey of project area seeps, springs, and stockponds.	1	Mining Company Colorado DMG OSM

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

W-1 - Complete a delineation survey of wetlands and other Waters of the U.S. proposed to be disturbed by surface facilities, including roads, on both coal lease tracts and the exploration license area prior to surface disturbance. The delineation must be conducted according to Corps of Engineers guidelines and coordinated with any seep and spring survey to be conducted in the future. The report produced need include a map depicting the locations and acreages of the delineated wetlands and other Waters of the U.S. which would be affected.

The lessors should then review this map and determine which impacts to wetlands and/or other Waters of the U.S. could be avoided or minimized and adjust surface disturbance locations accordingly. Permitting and mitigation planning, if required, would then follow according to appropriate agency guidelines. This measure would be highly effective in determining the acreage of wetlands and other Waters of the U.S. which could be affected, addressing avoidance and minimization requirements, and planning for mitigation, if necessary.

W-2 - A survey and ongoing monitoring of seeps, springs, and stockponds within the lease tracts and exploration license area would be valuable. The survey would include a delineation of both wetland and other Waters of the U.S. features and be completed according to Corps of Engineers delineation guidelines. The report would include a map depicting the locations of delineated wetlands and other Waters of the U.S. present, as well as information addressing the acreages and functions of the wetlands noted. This proposed mitigation measure would likely be a part of the permitting requirements of the Colorado DMG and the OSM for both the Iron Point and Elk Creek Coal Lease tracts. This measure would be effective in providing a means to determine which seeps, springs, and stockponds are affected by subsidence and what follow-up wetland mitigation measures might be required, if any.

3.9 TERRESTRIAL WILDLIFE

Issue: *Minimize the disruption to wildlife and wildlife habitats. Areas of concern include: the impacts to threatened, endangered, or sensitive species; impacts to deer habitat; loss of habitat and habitat effectiveness; and, impacts associated with continued and/or increased human activity.*

3.9.1 Introduction

This section addresses wildlife species of concern within the wildlife study area. The wildlife study area covered by this analysis encompasses the Elk Creek, Bear Creek, Terror Creek and East Fork of Terror Creek watersheds, as well as the lower and middle portions of the Hubbard Creek watershed. This area includes the entire coal lease tracts and the Iron Point Exploration License area as well as surrounding habitats. The extent and boundaries of the study area addressed by this document were delineated in consultation with Forest Service personnel. For most wildlife, direct, indirect, and reasonably foreseeable cumulative effects would be confined within the wildlife study area. However, for some species such as elk and deer and threatened and endangered species (bald eagle and peregrine falcon), larger regional population areas were evaluated to assess potential project related impacts.

Wildlife species and issues of concern addressed by this analysis were determined through consultation with state and federal agency personnel, a review of agency and public comments received during the EIS scoping process, and evaluation of potential species presence provided based on wildlife species ranges and other pertinent information sources. Identified wildlife concerns are as follows:

- Minimizing impacts to wildlife and wildlife habitats;
- Potential impacts of subsidence to unique habitats such as wetlands, riparian areas, and rock outcrop and wildlife species dependent on these habitats;
- Potential impacts of subsidence to wildlife water sources (e.g., seeps and springs);
- Potential for impacts to big game species (elk, mule deer, black bear, mountain lion);

- Increased potential for elk and mule deer/automobile and train collisions with increased traffic levels;

- Potential impacts to nesting golden eagles and other raptors; and

- Potential impacts to state or federally listed threatened, endangered, proposed, and candidate species as well as BLM species of special concern and forest sensitive species.

Information regarding wildlife species and current habitat conditions within the study area was obtained from a review of existing published sources, Forest Service file information, and Colorado Division of Wildlife WRIS mapping data.

3.9.2 Affected Environment

3.9.2.1 Habitat Overview

Eight vegetation communities/wildlife habitats exist within the study area. See *Figure 21, Vegetation Map*. A "Bare" habitat type is also present within the study area. Oak brush habitat is essentially ubiquitous across the mid to lower elevation portions of the study area occurring on ridge slopes, along ephemeral drainages, and over level to moderately rolling mountain meadows. Stands of aspen are located on side-slopes and in drainages at the mid to higher elevations. This habitat occurs on less steep slopes overall than the conifer communities. It intergrades with most of the other vegetation types on site, excepting the pinyon/juniper. Pinyon/juniper habitat is located on steep west and southwest-facing slopes at elevations generally below 7,000 feet. Areas of rock outcrop are a common habitat feature in the pinyon/juniper type. Steep to very steep canyon walls along Hubbard Creek and its tributaries support spruce/fir habitat. Elevations occupied by this conifer type normally range from 6,800 to 8,000+ feet.

Douglas-fir habitat is supported along the Terror, Hubbard, and Bear Creek drainages at elevations around 7,000 feet or less where the narrow canyon drainages and rapid runoff potentials preclude the establishment of the cottonwood habitat. This community is also found on north-facing ridge slopes primarily bordering Bear Creek. Cottonwood habitat is restricted to the south-central portions of Hubbard Creek at elevations below approximately 7,000 feet. Slopes are typically nearly level to level reflecting an overall wetter soil moisture regime as compared to the Douglas-fir and spruce/fir vegetation communities located in the drainages. Grass/forb habitat is scattered across the study area and is associated primarily with nearly level to moderately sloping sites on a variety of aspects. This community occurs as small natural clearings within other vegetation types, revegetated development disturbances, and heavily grazed meadows often associated with developed stockponds. The "Bare" habitat designation includes rock slides, steep-walled cliffs, and other areas which support little or no vegetation due to the surface expression of geologic material. Bare areas are also associated with the boundaries of the Terror Creek Reservoir. Further discussion and characterization of these vegetation communities/wildlife habitats is provided in Section 3.7, *Vegetation*.

3.9.2.2 Big Game

The project area occurs within Colorado Division of Wildlife Game Management Unit 521. Mule deer, elk, black bear, and mountain lion occur within the study area. Mule deer elk populations within the study area region exhibit seasonal movements to and from higher to lower elevation habitats, with most shifts in distribution occurring as a result of elevational migration in response to weather patterns and snow cover.

The majority of both coal lease tracts and the Iron Point Exploration license area represents summer range for mule deer while the lower elevations (approximately below 7,400 feet) are used as winter range (see *Figure 22, Mule Deer Range*). Preferred winter range areas are provided primarily by south and west-facing slopes of oak brush, mixed shrub, and pinyon-juniper habitats where browse is plentiful. Mule Deer Severe Winter Range and Winter Concentration Areas are located on the lowest elevation slopes where aspect and exposure limit snow accumulations. These areas are located along State Highway 133 and the North Fork of the Gunnison River below the confluence of Bear Creek and the North Fork of the Gunnison River (see *Figure 22, Mule Deer Range*). Severe Winter Range is defined as that part of the range where 90 percent of the individuals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten.

Elk winter range extends to higher elevations than mule deer winter range since elk are not as restricted by snow cover as mule deer. Elk summer range also does not extend to as low elevations as mule deer summer range since elk prefer the higher and cooler elevations where aspen and spruce/fir habitats provide thermal and security cover. Elk winter range generally occurs below the 8,000 to 8,400-foot elevation level (see *Figure 23, Elk Range*) and is typified by oak brush and mixed shrub slopes where exposure limits snow accumulation. Elk Severe Winter Range and Winter Concentration Areas are located on the lower elevation slopes within the Elk Creek drainage and along State Highway 133 and the North Fork of the Gunnison River below the confluence of Bear Creek and the North Fork of the Gunnison River (see *Figure 23, Elk Range*).

Elk calving or production areas are defined as the portion of the range occupied by cow elk from May 15 to June 15. No elk production areas have been identified by the Colorado Division of Wildlife within the two coal lease tracts or the Iron Point Exploration License area (see *Figure 23, Elk Range*). The only known production area near the study area is located at higher elevations within the uppermost portions of the Terror Creek and Hubbard Creek watersheds. Only known production areas are mapped by the Colorado Division of Wildlife, and elk calving activities also are likely to occur in other areas of suitable habitat. It is likely that some level of elk calving activity occurs in lower elevation aspen habitats within the Iron Point Exploration License area, especially in years with heavier accumulations of snow and delayed spring snowmelt.

The life history requirements of black bear are satisfied by a variety of habitats, including those present within the study area. Prime black bear habitat is characterized by relatively inaccessible terrain, thick understory vegetation, and abundant sources of shrub or tree borne soft or hard mast (Pelton, 1982). Black bears are omnivorous but feed primarily on herbaceous vegetation and berries. They become carnivores only when prey or carrion is readily available. Habitat areas of relative refuge from human populations are considered a prime requirement for sustaining stable black bear populations, although black bears can habituate to human presence (Pelton, 1982). Black bears are opportunistic and easily attracted by the presence of human food and garbage that is not properly stored. They can become a nuisance around areas of human habitation, especially in years when natural food availability is reduced. Black bears are relatively common in the study area, and Colorado Division of Wildlife WRIS mapping designates the entire area black bear overall range. Colorado Division of Wildlife WRIS mapping also indicates there is a black bear fall concentration area in the Upper Terror Creek drainage around the confluence of the East and West Fork of Terror Creek.

Mountain lion occur throughout the study area region with their range being closely tied to that of elk and mule deer. Mountain lion prey primarily on mule deer and young elk in this region and, like their prey, are typically wide-ranging. Mountain lions will follow their prey's seasonal movement and inhabit summer range or winter range in conjunction with deer and elk. They

are typically shy and avoid areas of human activity. As a result of their wide-ranging habits, population densities are usually low. Documented home ranges for mountain lion in the western United States range from 32.5 to 479.0 square kilometers (Anderson, 1983). Preferred habitat of mountain lions consists of rough or steep terrain in remote areas with suitable rock or vegetational cover. Colorado Division of Wildlife WRIS mapping indicates the entire study area is classified as mountain lion overall range.

3.9.2.3 Furbearers and Predators

Due to the secretive nature and nocturnal habits of many of the furbearers, little information on distribution and population densities within the region of the study area is available. Although specific information regarding population numbers and the distribution of most of these species does not exist, some general conclusions relating to species occurrence in the study area can be made based on known habitat preferences and habitats present. Furbearers and predators present in the study area include beaver, coyote, red fox, long-tailed weasel, badger, striped skunk, and bobcat.

Bobcat and coyote occur in a wide variety of habitats, and coyotes are likely to occur wherever suitable prey (rabbits, small mammals) are present. Bobcats are found most often in association with rugged areas of rimrock, broken terrain, and rock outcrop in a variety of woodland and shrubland habitats. Preferred prey includes large rodents, rabbits, and hares, although bobcats may switch to alternative prey when preferred food items become scarce (Koehler, 1987).

The distribution of beaver in Colorado is nearly statewide where suitable aquatic habitat is present (Fitzgerald et al., 1994). Suitable aquatic habitat for beaver is restricted to primarily the perennial portions of Terror Creek and Hubbard Creek. A large beaver pond complex is present in upper Hubbard Creek near the historic (now abandoned) Blue Ribbon Mine site.

The striped skunk prefers habitats near water but can be found far from water in a wide variety of habitats. This species is most common in agricultural areas at the mid to lower elevations and is not expected to be common in the study area. Badgers and long-tailed weasels are found at all elevations within the state (Fitzgerald et al., 1994). Long-tailed weasels are found in a diversity of habitats and are likely to be present throughout the upland portions of the study area. Badgers prefer grasslands, open shrublands, meadows, and open forests where an abundance of pocket gophers and ground squirrels occur.

Red fox are found throughout Colorado. In the mountainous portions of the state they prefer montane meadows, forest edges, and riparian areas (Fitzgerald et al., 1994). These are the most likely habitats that red fox would inhabit within the study area.

3.9.2.4 Waterbirds

Waterbirds include waterfowl, shorebirds, and other wading birds typically associated with wetlands and bodies of surface water. In the study area, suitable areas of aquatic and wetland habitat for waterbirds is restricted primarily to Hubbard Creek, Terror Creek, and Terror Creek Reservoir. High elevations in combination with the general lack of shallow-water shoreline areas and emergent vegetation around water bodies, favored by many species of waterfowl and shorebirds, limits waterbird use of the study area. Use of the study area for resting, feeding, or nesting by waterbirds is limited primarily to puddle ducks (such as mallard and teal), spotted sandpiper, and killdeer.

3.9.2.5 Raptors

Several species of raptors are known to occur and nest within the region of the study area. Potential breeders include turkey vulture, northern harrier, golden eagle, Cooper's hawk, sharp-shinned hawk, red-tailed hawk, prairie falcon, American kestrel, western screech owl, great horned owl, northern pygmy owl, long-eared owl, and northern saw-whet owl.

Nest site preferences of raptors potentially breeding in the area vary considerably. Red-tailed hawks, golden eagles and great horned owls typically nest in relatively large trees with open crowns or on cliff ledges and areas of rock outcrop. Great horned owls do not build their own nests and often occupy old nests of eagles, hawks, ravens, crows, and tree squirrels in larger trees or on cliff faces. Turkey vultures nest on cliff ledges and also in hollows in snags or stumps, or in caves while prairie falcon nests on scrapes on cliff ledges or in rock cavities. All of these species prefer primarily open shrublands and meadow areas for hunting. Suitable nesting habitat for these species is provided primarily by large cottonwood trees along the lower elevation portions of the drainages or by cliffs and rock outcrop along upper portions of the canyon edges. Nesting by a pair of golden eagles has been documented by the Forest Service in Upper Hubbard Creek canyon.

The remaining potential breeding raptors in the study area are associated primarily with forested habitats except for northern harrier. Northern harriers typically nest on the ground or in low shrubs in pockets of dense shrub and grass cover typically on drainage side-slopes or near wetlands. Cooper's hawks nest in aspen or in deciduous trees in riparian situations but are also known to nest in mature conifers (Ehrlich et al., 1988, Terres, 1980). Nests are typically constructed in an upper crotch of a tree near the trunk and below the canopy top. Sharp-shinned hawks, unlike Cooper's, nest in a wide variety of wooded habitats ranging from mountain mahogany stands to conifers. Nest configuration and placement is similar to Cooper's hawk. The American kestrel is a cavity nester and abandoned woodpecker holes, magpie nests, and crevices in rock outcrop are used as nest sites. A variety of open and wooded habitats are occupied by the American kestrel, although it avoids densely forested habitats.

Western screech owl, northern saw-whet owl, and northern pygmy owl nest in natural tree cavities or abandoned woodpecker or squirrel holes. Western screech owls are usually found in deciduous riparian habitats, while mature and old-growth mixed deciduous and coniferous forests are considered the best habitats for breeding for northern saw-whet and northern pygmy owls since the most suitable cavities for nesting are excavated by woodpeckers in large, diseased or dead trees (Reynolds et al., 1989). Northern saw-whet owls and northern pygmy owls occur over a relatively wide elevational range and have been found in low-elevation deciduous woodlands to high-elevation conifer forests (Reynolds et al., 1989). Northern saw-whet owls seem to prefer marshy or riparian areas within coniferous forests (Terres, 1980). Nests of northern pygmy owls are frequently next to meadow or marshy openings within deciduous woodlands and coniferous forests (Reynolds et al., 1989). Long-eared owl like great horned owl do not build their own nest and usually occupy abandoned magpie, hawk, crow, or squirrel nests it tall shrubs or trees (Ehrlich et al., 1988). They inhabit coniferous and mixed coniferous/deciduous woodlands. Nest sites are often at forest edges near water or moist meadow habitats (Terres, 1980). Suitable nesting habitat for all of these species, except western screech owl, may be provided within the study area by stands of aspen, Douglas-fir, and spruce/fir. Lower elevation riparian habitat along the creeks represent the only potential nesting habitat for western screech owl.

3.9.2.6 Songbirds and Other Avian Species

A variety of songbird and similar species reside within the study area. The majority of these species migrate south or to lower elevations for the winter months, and only a few species remain in the region during the winter months. Woodpeckers, jays, chickadees, nuthatches, and finches are representative year-round residents. Many of the migrants are neotropical species which winter in Central and South America. Neotropical migratory birds include a full array of species that require habitats ranging from early seral or successional stages to old-growth. Others prefer edge habitat areas that occur between forested and more open habitats.

Recent reductions in Neotropical migratory bird populations have been documented in the United States by the North American Breeding Bird Survey. The causes of these reductions are not fully understood but have been attributed to a variety of factors including: reduction and fragmentation of forested breeding habitat in the United States; nest predation and parasitism; and use of pesticides and deforestation in Central and South America.

3.9.2.7 Threatened, Endangered, and Other Species of Concern

No identified critical habitat for any state or federally listed threatened or endangered species has been identified within or near the study area. *Table 3.9-1, Threatened, Endangered, and Other Species of Concern Potentially Occurring in the Study Area*, lists federal and state threatened, endangered, and other species of concern potentially occurring in the study area.

Spotted bat has been found at scattered locations (primarily in arid country) in the western United States (Barbour and Davis, 1969). Habitat occupied by this bat ranges from low desert to montane coniferous forests normally below 8,000 feet in elevation (Watkins, 1977). They have been found in a variety of habitat types including open ponderosa pine, desert scrub, pinyon-juniper, and open pasture and hay fields. They roost alone in rock crevices high up on steep cliff faces. Cracks and crevices in limestone or sandstone cliffs provide important roosting sites (Leonard and Fenton, 1983), especially where rocky cliffs occur in proximity to riparian areas (Findley et al. 1975). Rock outcrop areas along Hubbard and Terror creeks represent the most suitable habitat areas for spotted bat within the study area.

Townsend's big-eared bats are normally found below 9,600 feet in elevation and apparently do not prefer dense coniferous forests (Barbour and Davis, 1969). This bat is usually found in small groups (10 to 100) in mine shafts, caves, and man-made structures, often in view of light. It occurs throughout most of Colorado, but its distribution seems to be determined by suitable roost and hibernation sites (Colorado Division of Wildlife, 1984). Suitable roost and maternity sites are not present within the study area, and it is unlikely that this species is a local resident. Therefore, no further analysis will be provided for Townsend's big-eared bat in this document.

The fringed myotis occurs as scattered populations at moderate elevations on the Western Slope of Colorado and has been found in association with ponderosa pine, pinyon/juniper, and scrub oak habitats (Colorado Division of Wildlife, 1984). It apparently is not common in Colorado, and has only been found at elevations up to 7,500 feet (Fitzgerald et al., 1994.). Caves, mines, and buildings are used as day and night roosts as well as hibernation sites. Suitable roost and maternity sites are generally lacking within the study area, and it is unlikely that this species is a local resident. No further analysis will be provided for fringed myotis in this document.

Bald eagles occur primarily as wintering birds in Colorado, and wintering populations are known to occur along the major river systems in the state. A few nesting records also exist for the state. In the study area, the bald eagle is only present as a winter resident along the North

Table 3.9-1
Threatened, Endangered, and Other Species of Concern Potentially Occurring in the Study Area

Common Name	Scientific Name	Status[1]
Mammals		
Spotted bat	*Euderma maculatum*	FS, SS
Townsend's big-eared bat	*Corynorhinus townsendii*	FS, SS
Fringed myotis	*Myotis thysanodes*	SS
Birds		
Bald eagle	*Haliaeetus leucocephalus*	T (proposed for delisting), ST
Northern goshawk	*Accipiter gentilis*	FS, SS
Flammulated owl	*Otus flammeolus*	FS
Three-toed woodpecker	*Picoides tridactylus*	FS
Black swift	*Cypseloides niger*	FS
Olive-sided flycatcher	*Contopus borealis*	FS
Southwestern willow flycatcher	*Empidonax traillii extimus*	E, SE
Golden-crowned kinglet	*Regulus satrapa*	FS
Loggerhead shrike	*Lanius ludovicianus*	FS
Amphibians and Reptiles		
Tiger salamander	*Ambystoma tigrinum*	FS
Boreal toad	*Bufo boreas boreas*	C, SE, FS
Northern leopard frog	*Rana pipiens*	FS

1 Status:
E = Listed Endangered by the U.S. Fish and Wildlife Service under the Endangered Species Act. Species which are in imminent jeopardy of extinction.
T = Listed Threatened by the U.S. Fish and Wildlife Service under the Endangered Species Act. Species which are threatened with extinction.
C = Listed as Candidate by the U.S. Fish and Wildlife Service. Taxa for which the Service has sufficient information to support listing as threatened or endangered.
SE = Listed by the Colorado Division of Wildlife as endangered in Colorado.
ST = Listed by the Colorado Division of Wildlife as threatened in Colorado.
FS + Classified as "sensitive" by the Regional Forester when occurring on lands managed by the U.S. Forest Service (5/6/94 draft listing).
SS = BLM listed species of special concern.

Fork of the Gunnison River drainage. This drainage and adjacent habitats are designated as a winter concentration area and winter range, respectively, by the Colorado Division of Wildlife (see *Figure 24, Bald Eagle Range*). Suitable winter habitat for bald eagles consists of secure diurnal perches, winter nighttime roosts protected from severe weather conditions, and foraging areas usually associated with large lakes or rivers (U.S. Fish and Wildlife Service, 1983). Although preferred wintering areas are usually near open water where eagles feed on fish or waterfowl, bald eagles will also hunt over open, upland areas if other food sources (e.g., rabbits or deer carrion) are readily available (Green, 1985). Kirk Madariaga, District Wildlife Manager with the Colorado Division of Wildlife, indicated that as many as four to five bald eagles may be

found along the North Fork of the Gunnison River near the two coal lease tracts during the winter months (Madariaga, pers. com., 1999).

The northern goshawk inhabits coniferous and mixed forests in much of the northern hemisphere. In Colorado northern goshawks nest in dense coniferous forest, often on north slopes and near water. Nesting also has been documented in aspen and in trees in riparian habitats at the lower elevations (Bailey and Niedrach, 1965). They can be found in any forested ecosystems in the Gunnison Basin area, but blocks of mature and old growth forest habitats (200 acres or greater) with a relatively open understory and small openings are preferred (Hayward et al. ,1990; Finch, 1992; Andrews and Righter, 1992). They are sensitive to human disturbance and have abandoned nests and young due to human activities that take place too close to their nest (Kennedy and Stahlecker, 1991). Mature stands of Douglas-fir and spruce/fir, especially with adjacent stands of aspen, within the study area represent potential foraging and nesting habitat.

Flammulated owls prefer mature ponderosa pine and Douglas-fir forests with open canopies. Old growth (>200 years) or mature (>150 years) stands of ponderosa pine and ponderosa/ Douglas-fir forests, often mixed with mature aspen, are preferred as nesting habitat (McCallum, 1994). A preference for stands with an open, park-like spacing of trees may be due to this species foraging habitats (Reynolds et al., 1989). Flammulated owls are obligate cavity nesters, and they nest in natural or woodpecker cavities. Both live and dead ponderosa pine, aspen, and Douglas-fir are used for nesting (Reynolds et al., 1989). Nesting territories are relatively small; a mean size of approximately 14 ha (34.6 acres) was reported by Linkhart (1984) for a population in Colorado. Mature stands of Douglas-fir and aspen represent potential habitat for this species in the study area.

Three-toed woodpeckers are associated primarily with mixed coniferous forests up to 9,000 feet in elevation. They require snags (standing, dead trees) for feeding, perching, nesting, and roosting, although they will feed in live trees. Foraging occurs in areas with abundant dead and decayed trees where it eats mostly larvae of wood-boring beetles by peeling the bark of dead conifers to extract wood boring insects (Terres, 1980). Snags at least 12 inches dbh (diameter at breast height) and 15 feet in height are required for its excavated nest cavities (Towry, 1987). Fire or insect killed trees are major food sources. Forest fires and areas of insect outbreaks may lead to local increases in woodpecker numbers after 3 to 5 years (Bull et al., 1986; Scott et al., 1980). The general lack of diseased or burned coniferous forest stands within the study area may limit the likelihood of local populations of three-toed woodpecker.

The black swift is considered rare to uncommon in all mountain ranges in the state except the San Juan Mountains (Andrews and Righter, 1992). Foraging birds range widely at high elevations over montane and adjacent lowland habitats. They nest on precipitous cliffs near or behind high waterfalls (Andrews and Righter, 1992). Preferred nesting habitat is lacking within the study area, but foraging birds may occasionally occur over the area.

The olive-sided flycatcher is a neotropical migrant songbird that is widespread in open, mature stands of coniferous forest from the Rocky Mountains westward. In Colorado it occurs in spruce/fir forests at elevations from 9,000 to 10,000 feet (Terres, 1980). It prefers forest edges near clearings, wooded streams, and lakes and is known to use burns and clearings, including clearcuts, for foraging. This species feeds on flying insects by darting out from high, exposed perch sites. Feeding and advertising behavior is characterized by conspicuous perching near the top of dominant trees or snags in the landscape. Snags or open branches are often used as perch sites, and populations are usually highest where snags are abundant (Ehrlich et al., 1988). This species breeds primarily in mature spruce/fir and Douglas-fir habitat and is a likely summer resident in these habitats within the study area.

The southwestern willow flycatcher is also a neotropical migrant songbird that winters in Mexico and Central America and breeds as far north as the Colorado River in western Colorado. In Colorado, willow flycatchers are considered an obligate riparian species that inhabit cottonwood-willow associations (Kingery and Dillon, 1987) and breed in close association with dense willow thickets (Sedgwick and Knopf, 1992). The breeding range of this subspecies includes areas of suitable habitat within the study area up to an elevation of 8,500 feet (USFWS, 1996). The only suitable areas of habitat for this species within the study area occurs in association with the large beaver pond complex on Hubbard Creek near the historic Blue Ribbon Mine. The periphery of these beaver ponds support dense stands of coyote willow (*Salix exigua*) that could support nesting activity by southwestern willow flycatcher.

Golden-crowned kinglets are considered uncommon to fairly common residents of the higher mountains in Colorado (Andrews and Righter, 1992). They breed primarily in mature, dense spruce/fir forests but can be found in all coniferous forest types and sometimes in lowland woodlands during the winter months. They seem to be most common in suitable habitats west of the Continental Divide (Andrews and Righter, 1992). Golden-crowned kinglet may inhabit mature stands of Douglas-fir and spruce within the study area.

Another neotropical migrant, the loggerhead shrike, prefers open country, thinly wooded, or scrubby land with clearings (Terres, 1980). Andrews and Righter (1992) report this species to be a fairly common resident in the western valleys of Colorado. Preferred habitats include open riparian areas, grasslands, shrublands, and open pinyon/juniper woodlands. While Robbins et al. (1989, as cited in Andrews and Righter 1992) indicate that this species has shown significant population declines over most of North America, populations appear to be stable in western Colorado (Lambeth, pers. com., as cited in Andrews and Righter, 1992).. Populations are declining in the midwestern and northeastern United States for reasons which are poorly understood. Population declines may be related to the decline in agriculture and increase in second-growth forests (Fraser and Luukkonen, 1986) and the use of pesticides (Ehrlich et al., 1988). Loggerhead shrike is likely a summer resident of lower elevations shrubland habitats within the study area.

Tiger salamanders occur in virtually all habitats where there is water nearby for breeding. They are usually absent from waters where predatory fish such as trout are present (Hammerson, 1986). Shallow pools in small wetland areas, Terror Creek Reservoir, backwater areas along perennial streams, and intermittent streams within the study area represent suitable breeding habitat for this species.

The boreal toad occurs in the mountainous portions of Colorado and is most common between 8,500 and 11,000 feet in elevation (Hammerson, 1986). They hide beneath rocks or logs or in rodent burrows when inactive. Toads emerge from hibernation in May to breed and return to hibernaculum in late August and September (Hammerson,1986). Preferred breeding habitats in Colorado include wet meadows, marshes, and the margins of beaver ponds and lakes (Hammerson ,1986). Boreal toads breed in any body of water lacking a strong current and with gradually descending banks at some point around the perimeter (Loeffler, 1998). Egg placement is usually in shallows where the thermal effects of the sun are optimized (Loeffler, 1998). Available evidence indicates that females may disperse over greater distances and into drier habitats than the males (Loeffler, 1998). Recent radio re-location studies of PIT-tagged (microchiped) toads by the Colorado Division of Wildlife indicate that male toads remain within 300 meters of breeding sites, while females can move up to 3 to 4 miles from breeding areas (Jones, pers. comm., 1999). Selected upland habitats for both males and females include aspen and conifer habitats with rocky areas or ground squirrel holes where toads seek refuge in rock crevices or rodent burrows to avoid temperature extremes and desiccation (Jones, pers.

comm., 1999). The boreal toad may be present in wetland areas with standing water at elevations above 8,500 feet within the study area.

Northern leopard frogs are a highly aquatic species and are usually found in close association with the banks and shallow water areas of permanent marshes, ponds, streams, lakes, and reservoirs. Water bodies with rooted aquatic vegetation are preferred (Hammerson, 1986). Pools and slow moving streams within meadow areas represent suitable habitat for northern leopard frog in the region. Lower elevation riparian areas within the study area may provide suitable habitat for northern leopard frog.

3.9.3 Environmental Consequences

The construction of various borehole, shaft, and access road facilities would create approximately 33.5 acres of new surface disturbance in currently undisturbed areas of vegetation communities/wildlife habitats. The principal wildlife habitats to be affected would be oak and aspen habitats. Potential effects to species of concern are greatest with loss of aspen, Douglas-fir, and cottonwood habitats, but most of these potential impacts can be avoided with the implementation of appropriate mitigation measures. Road activities associated with the proposed exploration of the Iron Point area would consist of the construction of 3 miles of new temporary road and approximately 4 miles of light reconstruction (spot blading 14-foot width on existing routes, removing rocks or tank traps). There is also a possibility of 3 miles of new road construction within the Iron Point Coal Lease Tract area on Forest Service lands in the vicinity of Section 34, T12S, R91W, to provide access to degasification boreholes. Potential impacts to deer and elk due to road construction and reconstruction would result from an increase in motorized travel in areas where there was previously none. This would cause a decrease in the areas habitat effectiveness (degree to which a physical wildlife habitat is free from man-caused disturbances, and therefore attractive to wildlife occupancy). The Forest Service requires conditions of approval for exploration licenses which include obliteration, and methods of obliteration for any new temporary roads and where necessary returning reconstructed roads to their original condition. These requirements, provided they are well designed, implemented and monitored, would maintain habitat effectiveness for deer and elk at the current level (Want, 2000).

Impacts to sensitive wetlands and riparian habitat as well as to potential breeding habitat for boreal toad and tiger salamander would occur if there was construction of a drill site access road along Hubbard Creek to drill site IP99-7. There is a Forest Service stipulation that precludes road and pad construction in riparian areas or wetlands. Indirect impacts would include the surface effects of subsidence (mainly the creation of surface cracks), a potential increase in train and vehicle collisions with wintering mule deer and elk, and potential changes in bald eagle winter habitat resulting from flow any reductions in the North Fork of the Gunnison River.

3.9.3.1 Effects of Alternative A (No-Action).

With this alternative, the coal lease tracts would not be offered for lease, and there would be no exploration drilling within the Iron Point Exploration License area. Wildlife resources in the lease areas would essentially remain in their existing condition. As a result, wildlife habitat distribution, extent, and condition as well as wildlife populations would remain similar to existing conditions, assuming there are no major alterations in current land use activities. Wildlife habitats within the study area would continue to be subject to low levels of use in the form of recreation, grazing, logging, and other incidental activities such as firewood harvesting. There would be approximately 15 acres of new disturbance on Oxbow's fee property associated with development of the Elk Creek portal facilities. Most of this disturbance would be in oak brush

habitat, but small amounts of cottonwood habitat in Elk Creek would also be lost to this development. These habitat losses would be small, next to an existing roadway, and are unlikely to have any measurable effect on existing wildlife populations. No active raptor nest sites or other sensitive habitat features would be affected by development of the Elk Creek portal facilities.

Traffic levels associated with mine personnel, train transport of coal, and truck transport of coal would remain the same, as would the risk of vehicle/deer and elk collisions along State Highway 133.. The conveyor planned to carry coal from the Bowie No. 2 portal area to the old State Highway 133 has the potential to disrupt mule deer and elk movement through winter range in this area unless properly designed underpasses are constructed at appropriate intervals along the length of the conveyor.

3.9.3.2 Effects Common to All Alternatives

Direct Effects - An estimated 33.5 acres is proposed to be disturbed by borehole, shaft, and access road construction under all action alternatives. Disturbance to existing vegetation communities/wildlife habitats from these activities was estimated to be: 23.1 acres in oak brush, 6.4 acres in aspen, 2.7 acres in grass/forb, and 1.3 acres in cottonwood or Douglas-fir habitats.

None of these disturbances would be in elk or mule deer severe winter range and winter concentration areas or in known elk production areas. These relatively small amounts of habitat disturbance in summer and winter range are unlikely to have any measurable effect on local elk and mule deer populations. Standard Forest Service stipulations regarding timing restrictions for surface disturbance and occupancy in elk winter range would eliminate any potential risk of indirect impacts to wintering elk from human presence. BLM also has a timing restriction as described in Unsuitability 15 in *Appendix C, Unsuitability Analysis Report - Iron Point Coal Lease Tract*, and *Appendix D, Unsuitability Analysis Report - Elk Creek Coal Lease Tract*. Minor habitat losses would also have minimal effect on wide-ranging species such as mountain lion and black bear.

Habitat effectiveness for deer and elk was determined by evaluating in combination, hiding and thermal cover, forage, road-density and human activity on roads. The HABCAP (Habitat Capability) model accomplishes this analysis. The GMUG Forest Plan directs the evaluation of road densities in combination with vegetative structure; therefore, the definition of habitat effectiveness is synonymous with habitat capability in this analysis.

The Iron Point Exploration License area is within Forest Plan management prescription 4B. The standard for wildlife habitat capability in this prescription is 80 percent. In all alternatives deer habitat capability remains above 80 percent. Elk habitat capability during summer (June-August) is currently above 80 percent. Factoring in the increase in motorized use during fall hunting seasons (September-October) elk habitat capability is currently 72 percent. In Alternatives B, C, and D elk habitat capability would remain above 80 percent during summer but would decrease to 70 percent during fall. The impact to elk would be a 2 percent decrease in habitat capability. This impact is from the possible 3 miles of road needed to provide access to degasification boreholes. Impacts to elk can be decreased by requiring access roads to degasification boreholes be authorized for special use and/or for foot and horse travel only. In addition, implementation of a closure order to motorized traffic in the Dove Gulch drainage and the Hubbard Canyon drainage from the Forest Service boundary at the south end to where the Old Hubbard Road crosses the powerline at the north end would increase habitant capability for elk during the fall (Wang, 2000).

With respect to threatened, endangered and other species of concern, no important or critical habitats of bald eagle and peregrine falcon would be directly affected by these surface disturbances. Southwestern willow flycatcher, boreal toad, northern leopard frog, and tiger salamander are dependent on aquatic and or wetland areas, and no surface disturbances are proposed in these areas. In addition, standard Forest Service stipulations would prohibit disturbance to these habitats including riparian areas. However, based on a field review of the proposed access road corridor to drill site IP99-7 in the Iron Point Exploration License area, it would be impossible to construct this road without impacting the riparian corridor along Hubbard Creek and also possibly wetlands along the creek bank. In many areas, the old degraded road bed is within the existing riparian corridor or is immediately adjacent to the creek bank. In addition, areas of unstable slopes have slumped across the old road bed and into the creek. Suitable habitat for southwestern willow flycatcher, boreal toad, and northern leopard frog is not present along this stretch of the creek, but potential breeding sites for tiger salamander may be present, and road building activities could adversely affect these areas.

Access roads or drill sites to be constructed in aspen, cottonwood, and Douglas-fir habitats create a potential impact risk to nest sites of forest nesting raptors such as northern goshawk, Cooper's hawk, sharp-shinned hawk, great horned owl, northern pygmy owl, long-eared owl, northern saw-whet owl, and flammulated owl. Nest sites of forested associated raptors could be impacted by direct loss or indirectly by adjacent human disturbance during the nesting season. Clearing of trees for construction could also result in the loss of snags that provide possible cavity nest sites for owls and important foraging and nesting sites for three-toed woodpecker. Snags also represent potential preferred perch sites for olive-sided flycatcher at forest edges.

There would be no disturbance of important habitats for spotted bat, Townsend's big-eared bat, and fringed myotis. Caves, old mines, and areas of rock outcrop suitable for roost, hibernation, or maternity sites for these species would not be affected by the proposed surface disturbances. There would also be no disturbance of potential nesting habitat (cliffs near waterfalls) for black swift.

There could be losses of potential habitat areas used by loggerhead shrike (oak brush) and golden-crowned kinglet (mature Douglas-fir stands), but these losses would be relatively minor. Individual birds could be affected by these losses, but minor habitat reductions would be unlikely to have any measurable effect on local populations.

Indirect Effects - The primary indirect impact that could affect local big game populations is the potential for an increase in vehicle and train killed mule deer and elk due to increased levels of employee traffic and coal transport (both train and truck) through elk and mule deer severe winter range and winter concentration areas along State Highway 133 and the North Fork of the Gunnison River. Based on conversations with Kirk Madariaga, District Wildlife Manager, Colorado Division of Wildlife (pers. comm. 1999), it could be expected that the number of vehicle and train/big game collisions would increase proportionately with the level of increase in train and passenger vehicle trips but not coal truck trips. His observations indicate that most road-killed deer and elk are killed in early winter by passenger vehicles and not by coal trucks, and the number of collisions drops off abruptly as winter progresses. He hypothesized that there were fewer collisions with coal trucks because coal truck drivers are more familiar with areas where mule deer and elk concentrate, and therefore, are better prepared to avoid collisions. According to Madariaga, approximately 5 to 10 elk and 20 to 30 mule deer are killed per year along Highway 133 in the general vicinity of the two mine operations. He also indicated that coal trains kill mule deer and elk, and in possibly higher numbers than those killed along the highway, since wintering elk and deer tend to concentrate more in areas along the

railroad right-of-way. However, he had no personal documentation to substantiate the number of train/big game collisions.

Dust control measures, increases in potable water consumption, and potential mine-related dewatering reductions in flow to Hubbard Creek would reduce flow by 35 to 355 acre-feet per year in the North Fork of the Gunnison River and could have an effect in fisheries in this river, especially during the winter months. Reductions in winter flows could also have an effect on the extent of ice free portions of the river. These indirect impacts could alter the suitability of the North Fork Gunnison River as a winter concentration area for bald eagles.

3.9.3.3 Effects of Alternative B

Direct impacts to wildlife habitats would be consistent for all alternatives. The only potential indirect impact that could vary with the different alternatives is subsidence. As noted in Section 3.4, Soils, the effect of subsidence would manifest itself as cracks forming on the earth's surface followed by a settling of the ground elevation as the geologic strata cave, at depth, behind the retreating longwall operation. Some cracks, devoid of vegetation, would remain on the surface at the conclusion of mining. The extent of wildlife habitat which would be affected by cracking cannot be calculated but would likely be minimal considering the potential acreage involved and the natural ability of these cracks erode, seal, and naturally revegetate. It is unlikely that a measurable acreage of wildlife habitat would be lost given these considerations.

Subsidence also has the potential to disrupt springs or other sources of surface water, thereby affecting important wetland and riparian habitats as well as watering areas for wildlife. However, if there is disruption of surface water sources, Forest Service standard stipulations would require the mine operator to replace this loss with water from an alternate source in sufficient quantity to maintain existing riparian habitat and wildlife use. Therefore, there should be no long-term adverse impacts to wildlife or wildlife habitat from disruption of surface water sources.

3.9.3.4 Effects of Alternative C

The effects of this alternative would be similar to Alternative B except for the indirect effects of subsidence. The effects of subsidence under Alternative C would be greater than under Alternative B given the adoption of multi-seam mining activities and the larger lease acreage involved. With multi-seam mining, the depth to which geologic strata cave behind the advancing mining operation would be greater. Given that the lease area under Alternative C is approximately 10 percent greater than under Alternative B, a comparatively larger acreage would be subject to the effects of subsidence.

3.9.3.5 Effects of Alternative D

Alternative D is identical to Alternative C except that special subsidence protection would be required under specific features such as Terror Creek, Hubbard Creek, and the Curecanti-Rifle 230/345 kV electric transmission line. Effects on riparian habitat in Terror and Hubbard Creeks would not be as likely to occur. As a result, the effects on existing wildlife habitats and populations would be the same only over a slightly smaller lease area. There would also be less risk of disruption of surface water sources and associated riparian habitats and wildlife watering areas.

3.9.4 Cumulative Impacts

Approximately 33.5 acres of wildlife habitat would be affected by surface disturbances on the lease and exploration areas. Seventy acres of previous disturbances are associated with the existing Bowie No. 2 Mine and approximately 95 acres have been disturbed at Oxbow's Sanborn Creek Mine. Approximately 10 to 15 acres and 15 acres of additional disturbances are planned at these two mining operations, respectively. The acreage of wildlife habitat that would be directly affected within the cumulative effects area by any action alternative represents a relatively minor short-term increase in lost habitat. The acreage of wildlife habitat affected by subsidence would not measurably increase habitat loss.

To assess cumulative impacts due to road densities habitat capability for elk and deer was evaluated using a larger area adjacent to the proposed exploration area. This area was delineated using elk and deer seasonal use patterns and includes a majority of elk and deer spring, summer fall and transition ranges and portions of winter range. In the cumulative area, habitat capability for deer in all alternatives would remain about 80 percent. Habitat capability for elk in summer is 73 percent and during fall is 58 percent. Implementing mitigation measures listed in *Table 3.9-2, Potential Mitigation and Monitoring Measures for Terrestrial Wildlife*, would maintain habitat capabilities in their existing condition (Wang, 2000).

Human population increases in the region due to expanded and continued mining, as well as to expected general population increases unrelated to mining, would create increases in human recreational activities, including hunting. Increased recreational use of public lands would place additional human disturbance pressures on wildlife populations as well as increase hunting pressure on big game populations. Limited timber harvesting is expected in the future within the Hubbard and Terror Creek drainages, but would be located north and west of the lease exploration area boundaries. The magnitude of these effects on regional wildlife populations is impossible to predict.

The effect on terrestrial wildlife of increasing production on the Elk Creek coal Lease Tract to 6 million tons per year would be minimal.

3.9.5 Potential Terrestrial Wildlife Mitigation and Monitoring

Aside from standard Forest Service stipulations imposed to protect wildlife and wildlife habitat and BLM unsuitability criteria, only three additional mitigation measures are proposed to protect habitat for wildlife species of concern. See *Table 3.9-2, Potential Mitigation and Monitoring Measures for Terrestrial Wildlife*.

Table 3.9-2
Potential Mitigation and Monitoring Measures for Terrestrial Wildlife

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
TW-1[3]	Minimize or prevent impacts to breeding species of raptors and their fledglings.	Survey specific forest habitats prior to construction for evidence of raptor nesting activity.	1	Mining Company Forest Service BLM
TW-2	Protect potential nest sites of sensitive avian species.	Survey proposed development sites located in forest habitats for snags.	1	Mining Company Forest Service BLM

Table 3.9-2 Potential Mitigation and Monitoring Measures for Terrestrial Wildlife				
Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
TW-3	Maintain habitat effectiveness for big game (especially elk).	Limit road construction. Design any necessary roads for minimal disturbance. Obliterate and reclaim any new temporary roads.	1	Forest Service BLM

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

TW-1 - For any construction activities in forested habitats of aspen, Douglas-fir, and cottonwood, these areas should be surveyed for evidence of raptor nesting activity prior to construction. If any nest sites are located, the timing and/or the location of construction should be modified to preclude any impacts to raptor nest sites. This mitigation would be effective in minimizing or preventing impacts to breeding pairs of raptors and their fledglings.

TW-2 - Since snags, and especially large snags, provide potential nest sites for cavity nesting owls, foraging and nest sites for three-toed woodpecker, and perch sites for olive-sided flycatcher, all proposed development sites in forested habitats should be surveyed for the presence of snags. If any snags are located, the locations of surface disturbance should be modified to the extent necessary to avoid the loss of snags. This mitigation would be effective in protecting potential nest sites for previously-mentioned species.

TW-3 - The use and construction of motorized roads, trails and temporary roads proposed within the Iron Point Exploration License area would be the primary concern related to habitat effectiveness for elk. Mitigation measures to decrease impacts to elk habitat effectiveness should include the following:

- Roads associated with degasification borehole access would be authorized by special use permit and/or restricted to foot and horse travel only.
- New temporary roads associated with proposed exploration would be designed so that there is minimal disturbance to topsoil and vegetation and located so that effective road closure would be more likely.
- New temporary roads would be obliterated using all or a combination of methods which include recontouring, discing or ripping, placing physical barriers at key points, seeding with a Forest Service approved seed mix, signing and closure orders.
- Roads which are reconstructed would be returned to their original condition so that there would be no net increase in accessibility to motorized traffic.
- Monitoring effectiveness of road obliterations and providing information to recreation users during high use periods would be necessary for at least 3 years following road closures.
- Closure orders to motorized traffic should be implemented in the Dove Gulch and Hubbard Canyon drainages.

3.10 AQUATIC RESOURCES/FISHERIES

Issue: *Minimize disturbance to fish habitat and fish populations. Areas of concern include: direct disturbance of stream channels; reduced flow; stream sedimentation; water quality degradation; and impacts to threatened and endangered aquatic species.*

3.10.1 Introduction

Fisheries and aquatic habitat information are discussed for streams, reservoirs, and ditches that are located within and surrounding the Iron Point and Elk Creek Coal Lease tracts and the Iron Point Exploration License area. Information was obtained by reviewing available literature and conducting a field reconnaissance on May 17 and 18, 1999. Water bodies that are located within or immediately adjacent to the study areas include Elk Creek, Bear Creek, Hubbard Creek, Alder Creek, Terror Creek, West Fork Terror Creek, Terror Creek Reservoir, and several irrigation ditches. Three of the streams (Hubbard, Terror, and West Fork Terror Creeks) are perennial streams that contain flows throughout the year. These streams support trout species and special concern fish species. Elk, Bear, and Alder Creeks are intermittent streams that do not contain year-round habitat for aquatic species.

Fisheries and aquatic information is also discussed for the North Fork of the Gunnison River and the Gunnison River. These streams contain important game fish species and federally endangered and special concern fish species.

3.10.2 Affected Environment

3.10.2.1 North Fork of the Gunnison River

The mainstem section of the North Fork of the Gunnison River is classified as Class I Cold Water Aquatic Life by the Colorado Department of Public Health and Environment. This classification is defined as " . . . waters that (1) currently are capable of sustaining a wide variety of cold water biota, including sensitive species, or (2) could sustain such biota but for correctable water quality conditions" (CDPH, 1999). Game fish species present in the river include rainbow trout, brown trout, cutthroat trout, and brook trout (Hebein, 1999). Rainbow, brown, and cutthroat trout were stocked in the river from 1973 through 1995. Based on surveys conducted by the Colorado Division of Wildlife, low to average numbers of trout were collected. Rainbow trout and brown trout usually represent the most abundant game fish species. Other game fish species such as northern pike and green sunfish sporadically occur in low numbers (Hebein, 1999). These species likely originate from Paonia Reservoir. Native species collected in the river consisted of roundtail chub, bluehead sucker, flannelmouth sucker, speckled dace, longnose dace, and mottled sculpin (see *Table 3.10-1, Fish Species Occurrence Within the Project Study Area Streams*).

Adequate habitat and water quality conditions are available in the North Fork of the Gunnison River to support trout populations. The general types of habitat present in the river below Hubbard and Terror creeks include a mixture of long runs and smaller riffles and pools. In wider sections of the river, the channel is braided with islands and side-channels. Fish cover is provided mainly by instream substrate and other structures. Factors that limit the quality of aquatic habitat include low summer flows due to irrigation diversions, return irrigation flows, siltation, general lack of cover, and livestock disturbance (Hebein, 1999).

Table 3-10-1
Fish Species Occurrence Within the Project Study Area Streams

Common Name	Scientific Name	Status[1]	North Fork Gunnison River	Hubbard Creek	Terror Creek	West Fork & East Fork Terror Creek	Gunnison River
Trout	***Salmonidae***						
Cutthroat trout	*Oncorhynchus clarki*	G	X	X	X	X	
Rainbow trout	*Oncorhynchus mykiss*	G	X	X			X
Brown trout	*Salmo trutta*	G	X	X			X
Brook trout	*Salvelinus fontinalis*	G	X	X		P[3]	
Pike	***Esocidae***						X
Northern pike	*Esox lucius*	G	X				
Carp/Minnows	***Cyprinidae***						
Humpback chub	*Gila cypha*	FE, SE					X
Bonytail[4]	*Gila elegans*	FE, SE					
Roundtail chub	*Gila robusta*	SSC; BLM SC	X	P[3]			
Red shiner	*Cyprinella lutrensis*	NG					X
Carp	*Cyprinus carpio*	NG					X
Sand shiner	*Notropis stramineus*	NG					X
Flathead minnow	*Pimephales promelas*	NG					X
Colorado pikeminnow	*Ptychocheilus lucius*	FE, SE					X
Longnose dace	*Rhinichthys cataractae*	NNG	X				
Razorback sucker	*Rhinichthys osculus*	NNG	X	X	X	X	X
Suckers	***Catostomidae***						
White sucker	*Catostomus commersoni*	NG	X	X			X
Bluehead sucker	*Catostomus discobolus*	SSC; BLM SC	X	X			X
Flannelmouth sucker	*Catostomus latipinnis*	SSC; BLM SC	X				X
Razorback sucker	*Xyrauchen texanus*	FE, SE					X
Catfishes	***Centrarchidae***						
Black bullhead	*Ameinus melas*	G					X
Channel catfish	*Ictalurus punctatus*	G					X
Sunfishes	***Centrarchidae***						
Green sunfish	*Lepomis cyanellus*	G	X				X
Smallmouth bass	*Micropterus dolomieui*	G					X
Largemouth bass	*Micropterus salmoides*	G					X
Sculpins	***Cottidae***						
Mottled sculpin	*Cottus bairdi*	NNG	X	X	P[3]		X

[1] Status: G = game fish; NG = introduced nongame; NNG = native nongame; FE = federally endangered; SE = Colorado endangered; SSC = Colorado special concern; and BLM SC = BLM special concern.
[2] These are the most abundant species; refer to Burdick (1995) for a list of other species in the river.
[3] P = Potential occurrence based on habitat.
[4] Bonytail does not occur in the Gunnison River, but it is present (rare) in the Colorado River.

3.10.2.2 Tributaries

The following information summarizes aquatic habitat and fisheries in project area tributaries. Two drainages, Hubbard and Terror Creek, both support trout populations. Three intermittent streams (Elk, Bear, and Alder creeks) do not contain game fish species or threatened, endangered, or special concern species. Trout and native fish species occur seasonally in Terror Creek Reservoir and the irrigation ditches (Terror Creek and Overland). However, drawdown in Terror Creek Reservoir in the summer restricts year-round habitat for fish. Based on discussions with the Colorado Division of Wildlife and the Forest Service, no macroinvertebrate surveys have been conducted in the tributaries.

Habitat conditions in Hubbard Creek are largely determined by gradient and channel configuration. In the lower two miles (i.e., above the North Fork of the Gunnison River confluence), the stream flows through canyon areas with moderately steep gradient. Riffles and runs represent the dominant types of habitat along with small side-pools. Boulders and cobbles are the predominant substrates. Fish cover is provided by instream substrate and woody debris (logs, tree limbs) and overhanging riparian vegetation. At an elevation of approximately 6,200 feet, the stream is characterized by lower gradient and a wider, meandering channel. A series of beaver ponds are located about 2,000 feet downstream of the historic (now abandoned) Blue Ribbon Mine area. Above the beaver ponds, the channel contains a more diverse mixture of pools, riffles, and runs. Higher quality habitat for fish is present in the form of undercut banks, instream substrate, and overhanging willows. The Colorado Division of Wildlife indicated that stream reaches below 9,800 feet and gradients less than 3 percent are the most productive trout habitat (Forest Service, 1986).

Habitat conditions at most of the proposed exploration drill sites mainly reflect a steeper gradient stream, as shown in Table *3.10-2, Summary of Aquatic Habitat Conditions at Proposed Exploration Drill Sites Near Hubbard Creek*. Drill Site IP99-22, which is located in the upper portion of Hubbard Creek, was not accessible. However, gradient in this area was less than IP99-23 through IP99-27. Some factors that limit aquatic habitat in Hubbard Creek include erosion, excessive siltation, and water diversion for irrigation.

Two instream flow recommendations were appropriated for Hubbard Creek in 1984 by the Colorado Water Conservation Board: 4 cubic feet per second (cfs) in an 8.1-mile segment in the headwaters and 3 cfs in a 2.5-mile segment in T2S, R91W, Sections 14, 23, 26, and 35. The purpose of the recommendations was "to preserve the natural environment to a reasonable degree" (Colorado Water Conservation Board, 1984).

Hubbard Creek provides habitat for trout and native fish species. Trout species present in the stream include rainbow, brown, brook, and cutthroat (Wang, 1998; Colorado Division of Wildlife, 1978). The Colorado Division of Wildlife stocked several varieties of cutthroat trout and rainbow trout between 1973 and 1996. Although Colorado River cutthroat trout were included in some of these stocking efforts, interbreeding with other cutthroat varieties has resulted in no pure strains being present. Other fish species inhabiting Hubbard Creek include bluehead sucker, speckled dace, white sucker, and mottled sculpin (BLM, 1998; Colorado Division of Wildlife, 1978). West Fork Hubbard Creek contains the same trout and native fish species.

The Terror Creek drainage (East Fork Terror, West Fork Terror, and Terror creeks) is characterized as moderately steep with gradients ranging from approximately 5 to13 percent. Within the project study area, elevations vary from approximately 6,700 to 7,800 feet. Stream widths vary from 5 to 20 feet with boulder-dominated substrates in most segments. Cobbles and gravel substrates are also present. Cascading riffles, short runs, and relatively small pools are the types of general habitat. Fish cover is provided by overhanging riparian vegetation,

Table 3.10-2 Summary of Aquatic Habitat Conditions at Proposed Exploration Drill Sites Near Hubbard Creek			
Drill Site Numbers	**Gradient**	**General Type of Habitat**	**Fish Cover**
IP99-23 - IP99-27	Moderately steep	Riffles and runs with small side pools; boulders and cobbles	Instream substrate, overhanging willows
IP99-7	Low gradient	Long pool with silt-dominated substrate	Depth
Downstream of IP99-7	Moderately steep	Riffles and runs with moderately large side pools; boulders and cobbles	Instream substrate, overhanging willows instream debris (logs)

instream substrates, and woody debris. The Colorado Division of Wildlife rated fish habitat in East Fork Terror Creek as poor and West Fork Terror Creek as average. Limiting factors for fisheries in the drainage include siltation, erosive soils, and lack of water during the summer through winter period (Colorado Division of Wildlife, 1978).

Based on limited sampling in West Fork Terror and East Fork Terror creeks, fish species in the drainage consist of cutthroat trout and speckled dace. The lower portion of Terror Creek near the confluence with the North Fork of the Gunnison River may also support species such as longnose dace, mottled sculpin, flannelmouth sucker, and bluehead sucker. Cutthroat trout were stocked in Terror Creek in 1982 and 1988 through 1996. The upper portions of the drainage also may contain brook trout, as this species was observed in Terror Creek Reservoir (Rudin, 1999).

3.10.2.3 Gunnison River

The 75-mile section of the Gunnison River between its confluences with the North Fork of the Gunnison River and Colorado River is classified by the Colorado Department of Public Health and Environment (1999) as Class I Cold Water Aquatic Life. However, recent fish surveys in the Gunnison River indicated a cold water fishery in the upper portion of this segment and a warm water fishery in the lower portion (Burdick, 1995). After constructing the Aspinall Unit, the transition zone from cold water fish species to warm water species was determined to be between the confluence with the North Fork of the Gunnison River, River Mile (RM) 75 and Drysdale Flats (RM 67). The warm water fishery was dominated by native fish species. In 1992 and 1993, approximately 79 percent of the total catch was comprised of native species, largely due to bluehead sucker, flannelmouth sucker, and roundtail chub (Burdick, 1995). Carp and white sucker were the most frequently encountered non-native species by comprising 7 and 6 percent of the total catch, respectively. Numerous minnow species such as red shiner, sand shiner, fathead minnow, and speckled dace also were collected in seining surveys. Rainbow trout and brown trout, which individually comprised approximately 2 to 3 percent of the total catch, were the most abundant game fish species. The highest trout numbers were collected between RM 60 and 75. Other game fish species that individually comprised less than 1 percent of the total catch included northern pike, black bullhead, channel catfish, green sunfish, largemouth bass, and smallmouth bass.

Relatively diverse aquatic habitat conditions are found in the Gunnison River between the North Fork of the Gunnison River and Colorado River confluences. From the North Fork confluence (RM 75) to Drysdale Flats (RM 67), the river flows through a wide canyon. An extensive floodplain occurs from RM 67 downstream to Roubideau Creek (RM 50), which contain a variety of habitats such as braided channels, vegetated islands, long runs, riffles, and backwaters (Burdick, 1995). From RM 50 to Whitewater (RM 15), the river flows through

narrow canyon areas. A mixture of moderate velocity riffles, quiet shorelines, and slow runs are found between Whitewater and the Redlands Diversion Dam (RM 3). A canyon area exists just above the Redlands Diversion Dam. Restoration activities in the Gunnison River have involved the construction of the fish passageway at the Redlands Diversion Dam, flow recommendations, and restoration of wetland habitats adjacent to the river (Burdick, 1995).

3.10.2.4 Threatened, Endangered, and Sensitive Species

Four federally endangered fish species occur in river segments located downstream of the coal lease tracts: Colorado pikeminnow (squawfish), razorback sucker, humpback chub, and bonytail. Colorado pikeminnow and razorback sucker presently occur in the Gunnison River. Three special concern species (Colorado and BLM) also are present in downstream areas: bluehead sucker, flannelmouth sucker, and roundtail chub. Although Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), (Forest Service sensitive and Colorado special concern species) were previously stocked in Hubbard and Terror Creeks, the populations are not considered pure strains (see Section 3.10.2.2, Tributaries). The following information summarizes the distribution, critical habitat designations, habitat use, and spawning periods for these species except Colorado River cutthroat trout.

Colorado Pikeminnow - Downstream river segments inhabited by Colorado pikeminnow include the Gunnison and Colorado rivers. In the Gunnison River, the present distribution includes the lower 30 to 40 miles. The upper distribution is between Bridgeport at RM 30 and the Escalante Bridge (RM 41.9) (Burdick, 1999). Between 1918 and the spring of 1996, this species was limited to the lower 3 miles of the Gunnison River because of the Redlands Diversion Dam (RM 3). In June 1996, a fish ladder was constructed at the Redlands Diversion Dam, which allowed fish to move upstream of the dam. This species also is found in the mainstem portion of the Colorado River near Palisade, Colorado downstream to Lake Powell (USFWS, 1994). Six critical habitat reaches have been designated for this species in the Colorado River drainage (USFWS, 1994). Two reaches are located downstream of the coal lease tracts: (1) Gunnison River and its 100-year floodplain from its confluences with the Uncompahgre and Colorado Rivers; and (2) Colorado River and its 100-year floodplain from the Colorado Bridge at exit 90 north of Interstate 70 (RM 238) downstream to the Dirty Devil arm of Lake Powell.

Habitat requirements of Colorado pikeminnow depend upon the life stage and time of year. Young-of-the-year (YOY) and juveniles prefer shallow backwaters, while adults prefer pools, eddies, and deep runs (Miller et al., 1982). Adults seem to prefer depths of about 2 to 7 feet, velocities of 0 to 0.2 feet per second, and boulder/silt substrates (Valdez et al., 1982). Juveniles and YOY are usually found over silt or sand bottoms with minimal current (Tyus et al., 1982). During peak runoff in the spring and early summer, fish usually move into backwater areas of flooded riparian zones to avoid swift velocities, feed, and prepare for the upcoming spawning period (Valdez and Wick, 1983). As adults mature, they become highly mobile during the spawning period, which occurs after peak runoff from mid-June to mid-August. Larvae drift downstream from spawning sites beginning in late June and continue until late August.

Razorback Sucker - The Gunnison and Colorado rivers represent the closest downstream rivers inhabited by razorback sucker. In the Gunnison River, wild razorback sucker are thought to be extirpated (Burdick and Bonar, 1997). As a result, approximately 4,938 juvenile and sub-adults have been stocked between October 1995 and October 1998 (Pfeifer and Burdick, 1998). The stocking program has extended the distribution in the Gunnison River from the Hartland Diversion Dam at RM 60 downstream to the confluence with the Colorado River. Razorback sucker also are found at scattered locations in the Colorado River. Critical habitat has been designated for 15 reaches in the Colorado River Basin. The closest downstream

reaches in relation to the coal lease tracts include (1) Gunnison River and its 100-year floodplain from its confluences with the Uncompahgre River to the Redlands Diversion Dam; and (2) Colorado River and its 100-year floodplain from the Colorado Bridge at exit 90 north of Interstate 70 (RM 238) downstream to Westwater Canyon (USFWS, 1994).

Habitat requirements for razorback sucker reflect both riverine and reservoir environments. General habitats used by adults include eddies, pools, and backwaters during the non-breeding period (July through March) (Maddux et al., 1993). Osmundson and Kaeding (1991) summarized seasonal habitat use as follows: pools and eddies from November through April, runs and pools from July through October, runs and backwaters in May, and backwaters and flooded gravel pits during June. Juveniles seem to prefer shallow water and minimal flow in backwaters, tributary mouths, off-channel impoundments, and lateral canals (Maddux et al., 1993). The spawning period for razorback suckers in the Upper Colorado River Basin usually occurs in April through mid-June. However, limited spawning has been documented for this species in the Upper Colorado River basin.

Humpback Chub - The occurrence of humpback chub is limited to one known recent record in the Gunnison River and river canyon sections in the Colorado River. One humpback chub was captured in a canyon-reach of the Gunnison River in 1993 (Burdick, 1995). In the Upper Colorado River, this species is found in the Black Rocks and Westwater Canyon reaches near the Colorado-Utah state line, Professor Valley near Moab, and Cataract Canyon near Lake Powell (Maddux et al., 1993). Seven critical habitat designations exist within the Colorado River Basin. Of these reaches, two are located downstream of the Bowie and Oxbow mines in the Upper Colorado River: (1) Black Rocks to Fish Ford River; and (2) Brown Betty Rapid to Imperial Canyon just upstream of Lake Powell (USFWS, 1994).

Humpback chub are mainly found in river canyons, where they utilize a variety of habitats. In general, they prefer deep pools (about 25 to 65 feet deep), eddies, and upwells near boulders, steep dropoff cliff faces, and sand/gravel bars near boulders (Maddux et al., 1993). YOY chubs usually are found in backwaters and quiet pockets of water on rock benches or along steep rock walls (Valdez and Clemmer, 1982). Juveniles occur in backwaters, eddies, and runs, with low velocities and sand, silt, or boulder substrates (Valdez et al., 1982). Spawning occurs in May through July after the peak spring flows at water temperatures ranging from about 50° to 68° F (Maddux et al., 1993).

Bonytail - The bonytail is considered to be the rarest of the four Colorado River federally endangered fish species. Since intensive sampling began in 1977, only a few individuals have been collected in the Upper Colorado River Basin. In the mainstem portion of the Upper Colorado River, one to five individuals were collected in the Black Rocks area, Cataract Canyon about 20 miles upstream of Lake Powell, and Lake Powell (Kaeding et al., 1986; Maddux et al., 1993). No bonytail have been collected in the Gunnison River.

The general types of habitat used by bonytail include mainstem river and impoundments on the Colorado River. Collection sites for this species in the Upper Colorado River Basin were characterized as deep pools and eddies with slow or fast currents (Kaeding et al., 1986). Substrates at the collection sites consisted of silt, silt-boulder, and boulders (Vanicek and Kramer, 1969). Limited information is available concerning spawning requirements for this species. It is assumed that spawning occurs in June or July, based on studies in the Green River.

Flannelmouth Sucker and Bluehead Sucker - These native suckers occur in the North Fork Gunnison, Gunnison, and Colorado Rivers. Both species are found in a variety of habitats that include riffles, pools, runs, and backwater areas in larger streams and rivers (Sublette et al.,

1990). In most instances, the streams have minimal vegetation, moderate to high turbidities, and high spring flows. Depths usually range from 1 to 6 feet, with substrates consisting of rocks, gravel, or mud (Sigler and Miller, 1963). Spawning occurs in the spring or early summer at lower elevations and in summer at higher elevations.

Roundtail Chub - This species also occurs in the North Fork of the Gunnison River, Gunnison, and Colorado Rivers. Roundtail chub inhabits pools, eddies, runs, and riffles in moderate to large rivers (Karp and Tyus, 1990; Sublette et al., 1990). Adults prefer pools associated with undercut banks and other types of cover, while young fish occur in shallower water with lower flows. All age groups prefer cobble-rubble, sand-cobble, or sand-gravel substrates (Sublette et al., 1990). Runs and riffles are used primarily during feeding periods. Spawning occurs in the spring and early summer when water temperatures are approximately 68° F (Sublette et al., 1990).

3.10.3 Environmental Consequences

Short-term, local increases in turbidity and suspended sediments could occur during exploration activities adjacent to Hubbard Creek and Terror Creek, and along access roads adjacent to Hubbard and Terror creeks that would be constructed for mining both the Iron Point and Elk Creek Coal Lease tracts. These short-term increases in sediment yield could result in short-term effects on aquatic species and their habitat. Sediment concentrations would stabilize and return to typical background concentrations after the construction activities are completed. By implementing proper drainage and detention structures, the impact of increased sediment levels on aquatic species and their habitat would be low. Any localized increases in sediment would not affect downstream areas in the Gunnison and Colorado rivers that are inhabited by four federally endangered fish species.

The use of water for mining activities, dust control, and domestic purposes would result in a relatively small depletion of water from Terror Creek, Hubbard Creek, and the North Fork of the Gunnison River. Water would be provided from existing sources. The estimated withdrawal of water would result in total reductions less than 1 cfs. This small depletion would represent a relatively small reduction in habitat for fish and benthic macroinvertebrate species. This depletion would be even smaller in the sections of the Gunnison and Colorado rivers that are inhabited by four federally endangered fish species.

Mine dewatering also could result in reduced flows in the middle and lower portions of Hubbard Creek (near and downstream of the historic Blue Ribbon Mine). The estimated volume of water removed from the Hubbard Creek drainage due to underground mining could range from approximately 35 to 355 acre-feet per year, with an average of 195 acre-feet per year. These volumes would represent approximately 0.1 to 14 percent reductions in the base flow conditions in Hubbard Creek. Impacts associated with this depletion would be reduced habitat for fish and macroinvertebrate communities in Hubbard Creek. A relatively small depletion also would occur in the North Fork of the Gunnison and Gunnison rivers. Special concern fish species are present in both rivers, while two federally endangered fish species occur in the Gunnison River.

Actual water depletion estimates would be made during the mine permitting and mining plan decision processes with Colorado DMG and OSM. Final consultation with the U.S. Fish and Wildlife Service (USFWS) would occur at that time. As part of the NEPA process, initial consultations were done with USFWS for the purpose of this analysis.

Mining operations for both coal leases would result in increased discharges to the North Fork of the Gunnison River. However, since all discharges must meet federal and Colorado

Department of Public Health and Environment regulations, no adverse effects on aquatic species are anticipated due to the quality of the discharge water.

The use and transport of fuels to the exploration sites and mining operations would represent a risk to aquatic species and their habitat, if a spill or accident occurred. By implementing a mitigation measure that would restrict the use of fuels near streams, water bodies and their associated biological communities would be protected. The risk of a fuel spill or leak reaching the North Fork of the Gunnison River, Hubbard Creek, or Terror Creek during transport is considered extremely low, based on the expected low frequency of traffic.

3.10.3.1 Effects of Alternative A (No-Action)

Under the No-Action Alternative, present mining operations would continue for the existing Bowie and Oxbow properties. Short-term, local increases in turbidity and suspended sediments would occur in the vicinity of new surface disturbance areas, which include a new conveyor belt and coal storage loadout area for the Bowie No. 2 Mine and construction of the Elk Creek portal on private land for the Oxbow property. The closest drainages in relation to the new disturbance areas include Elk Creek for the Oxbow property and the North Fork of the Gunnison River for the Bowie No. 2 property. The North Fork of the Gunnison River contains both game and non-game fish species, while the intermittent Elk Creek does not support a fishery. By implementing required erosion and sediment control measures, the potential effects of any increases in sedimentation would be considered minor. Any localized increases in sediment would not affect water quality in the Gunnison River, which is inhabited by two federally endangered fish species, Colorado pikeminnow and razorback sucker.

The continued operations of both properties would require water for domestic use, and underground and surface dust control. Existing water sources would be used. In 1996, the Office of Surface Mining, Reclamation, and Enforcement consulted with the U.S. Fish and Wildlife Service on the following volumes of water: 93.2 acre-feet for Oxbow and 187.8 acre-feet for Bowie. A portion of the Oxbow use is discharged to the North Fork of the Gunnison River under an existing NPDES permit. These volumes represent a total of less than 0.5 cfs for both the Bowie and Oxbow operations. Existing water sources would be used.

Mine water would continue to be discharged for both operations at the present levels. No additional sedimentation ponds or new discharge points would be required. By meeting the required NPDES water quality standards, no adverse impacts to water quality or aquatic species and their habitat would occur as a result of the No-Action Alternative.

3.10.3.2 Effects Common to All Action Alternatives

Direct Effects - The potential effects of the action alternatives on aquatic resources are closely related to impacts on surface water and groundwater resources, which are discussed in Section 3.5, Surface Water Hydrology, and Section 3.6, Groundwater. Direct impacts to aquatic resources could result from four factors: changes in water quality, water withdrawals, mine dewatering, and physical habitat disturbance. The following information describes potential impacts on aquatic resources that are common to all action alternatives. Differences in potential effects on aquatic resources are discussed separately for each alternative.

Water would be used for exploration, underground and surface dust control, and domestic purposes for all action alternatives. Estimates for water use are depicted in *Table 3.10-3, Estimated Water Withdrawals for Action Alternatives.* The overall total volume would represent approximately less than 0.5 cfs. These slight reductions in flow would result in a relatively small reduction in wetted habitat for fish and benthic macroinvertebrates in Terror and Hubbard

Table 3.10-3 Estimated Water Withdrawals for Action Alternatives			
	Iron Point Exploration License	Iron Point Coal Lease Tract	Elk Creek Coal Lease Tract
Estimated Water Use (acre-feet per year)	3 - 6	200 - 250	150 - 200

creeks. The small magnitude of flow reduction would not be expected to affect spawning or rearing habitat for trout species in these creeks. An even smaller reduction in habitat would occur in the North Fork of the Gunnison River, which is inhabited by trout. Potential impacts on threatened, endangered, or special concern species are discussed at the end of this subsection.

Mine dewatering for the Iron Point Coal Lease Tract also would result in reduced flows in the middle and lower portions of Hubbard Creek (near and downstream of the historic Blue Ribbon Mine), as discussed in Section 3.6, Groundwater. The estimated volume of water removed from the underground mine area would be an average of 195 acre-feet per year. This volume could result in flow reductions of approximately less than 1 cfs in Hubbard Creek. Impacts associated with this depletion would be reduced habitat for fish and macroinvertebrate communities.

In relation to the instream flow recommendations that were appropriated for Hubbard Creek by the Colorado Water Conservation Board (i.e., 4 cfs in a 8.1-mile segment in the headwaters and 3 cfs in a 2.5-mile segment in T12S, R91W, Sections 14, 23, 26, and 35), water use for exploration could contribute an extremely small depletion (less than 0.05 cfs per week) to periods when baseline flows could be less than 3 cfs at the Lower Hubbard Creek segment. This would be a short-term impact that could occur for several months during 2 years. Sections of Hubbard Creek potentially affected by mine dewatering are located downstream of the 2.5-mile segment with a minimum instream flow recommendation.

Potential water quality impacts from sedimentation and fuel or chemical spills could adversely affect aquatic resources. The impacts of fuels and other chemical spills depend on the volume spilled, proximity to the stream, time of year, flow conditions, physical characteristics of the streams and the response and effectiveness of the cleanup and control techniques. The types of chemicals transported to the mine sites or stored at the sites include gasoline, diesel fuel, and small amounts of solvents and other miscellaneous chemicals. It is assumed that fuel would be transported by local suppliers, which would involve a transportation route along State Highways 92 and 133. Both highways are parallel to and cross the North Fork of the Gunnison River, although State Highway 133 is considerably closer to the river.

Petroleum products exhibit both acute lethal toxicity (short-term) and long-term sublethal chronic effects on aquatic organisms. If a spill or leak entered a water body (Hubbard Creek, Terror Creek, or North Fork of the Gunnison River), aquatic organisms could be exposed to lethal conditions. Because the aromatic (most toxic) components of gasoline and diesel fuel would volatilize rapidly after being released, the period of exposure would be relatively short (Edgerton et al., 1987; Markarian et al., 1994). Previous biological studies conducted after gasoline and diesel fuel spills have shown that toxic conditions existed for periods ranging from several hours to several weeks, depending upon the factors listed above (Bury, 1972; Pontasch and Brusven, 1988; ENSR, 1989; and Green and Trett, 1989). As a result of the low persistence of gasoline and diesel fuel and high reproductive rates, macroinvertebrate communities typically recover within about 6 to 12 months. The recovery period for fish ranges from less than one year to about 2 years, depending upon impacts to early life stages (Green

and Trett, 1989). A spill or leak during the spring or fall spawning and fry development periods for trout could potentially result in more severe impacts that could take several years for recovery.

Potential effects of solvent or other chemical spills or leaks would not likely affect surface water and aquatic communities. These chemicals would be stored in areas located outside of any intermittent or perennial drainages. Although localized spills or leaks may occur, cleanup and containment would eliminate the risk of these chemicals entering surface waters that contain fish and invertebrate communities.

In general, disturbance to aquatic habitat from construction of exhaust shafts, degasification boreholes, ventilation shaft, and access roads would be minor. In most instances, these construction areas are not located within intermittent or perennial drainages. One road crossing may be required on Bear Creek, an intermittent stream, which could result in short-term, temporary increases in sediment. Sediment increases in a localized area downstream of the crossing may cover substrates and reduce macroinvertebrate production. No game fish species occur in this stream. By implementing proper drainage and sediment control measures and timing the construction during a low flow period, the effects on macroinvertebrates would be considered minor.

Exploration activities would require construction of approximately 2 miles of new access roads and drilling operations at 26 boreholes. Vehicle traffic along existing roads adjacent to Terror and Hubbard Creeks could result in relatively small magnitude, short-term increases in sediment, as airborne particles and surface soil are deposited in streams. The expected small relative increase in sediment levels from vehicle traffic would not likely affect macroinvertebrate and fish productivity. Although not anticipated, construction of a new road along Hubbard Creek to access drill hole IP99-7 would result in increased sediment to Hubbard Creek. This 1.5 mile section of Hubbard Creek exhibits considerable slumping and erosion on the west side of the channel. Disturbance to the area adjacent to the creek could result in relatively large sediment increases that could affect macroinvertebrate and fish communities. Sediment could cover substrates used by macroinvertebrates and alter habitat used by trout for spawning and fry development. The accumulation of fine sediments adversely affects biotic communities by physically covering animals, reducing oxygen availability, reducing food, and eliminating spawning areas (Waters, 1995).

Exploration activities also may require the construction of a sump pit for drilling fluids at each of the drill hole sites; however, most exploration would be conducted using a closed system. Spills or leaks from the sump pit could contribute sediment to the stream. Fluids in the sump pits consist of drilling muds and bentonite material. The effects of drilling muds on aquatic communities would be similar to sedimentation impacts. By adhering to proper design of the sump pits, spills or leaks of reserve pit fluids to adjacent streams would be minimized. If a spill or leak occurred, cleanup and containment procedures would be required to reduce impacts to surface water and aquatic communities and their habitat. After completing the exploration activities, each site would be reclaimed. The sump pits would be regraded and disturbed soil would be recontoured and revegetated.

Mining operations associated with all action alternatives also would require increased discharges to sedimentation ponds and the North Fork of the Gunnison River. Under each alternative, discharges would need to meet NPDES requirements. Periodic monitoring of mine effluents would ensure that effluents were not adversely affecting water quality or causing potential toxic effects on aquatic organisms. If concerns were identified during monitoring, corrective actions would be implemented to make sure that water quality and toxicity objectives were met.

The potential effects of all action alternatives on the federally endangered and special concern fish species that occur in the Gunnison and Colorado rivers would be limited mainly to water use and mine dewatering. Water withdrawals for exploration, dust control, and domestic use and mine dewatering would represent an extremely small depletion in the Gunnison and Colorado rivers, which are inhabited by Colorado pikeminnow, razorback sucker, bonytail, and humpback chub and three special concern species (flannelmouth sucker, bluehead sucker, and roundtail chub). By itself, the project-related depletions would not measurably affect flows in either occupied or critical habitat areas for the federally endangered fish species. However, the U.S. Fish and Wildlife Service considers any depletion in the Upper Colorado River Basin as potentially contributing to impacts on the endangered fish species.

Since the project area for the proposed mines is located at least 40 miles upstream from the closest occupied or critical habitat reaches for the endangered fish species (i.e., confluence between the North Fork of the Gunnison and Gunnison rivers), no additional impacts are expected. Potential increases in sedimentation or water quality changes due to fuel spills would be limited to drainages within the project study area or the North Fork of the Gunnison River.

Of the various project impacts discussed above, sediment increases and potential fuel spills could directly affect the special concern species that inhabit the lower portion of Hubbard Creek and the North Fork of the Gunnison River.

Indirect Effects - Increases in the local population as a result of all action alternatives could result in increased fishing pressure in Hubbard and Terror Creeks. If a new road is constructed along Hubbard Creek as part of exploration, new vehicle access could allow additional fishing in Hubbard Creek. It is assumed that fishermen would adhere to Colorado Division of Wildlife regulations, which restrict the number of trout harvested from these streams.

3.10.3.3 Effects of Alternative B

The direct and indirect impacts of Alternative B on aquatic resources would be the same as discussed for all action alternatives. An additional impact that could occur under Alternative B would be potential subsidence and erosion effects on Hubbard and Terror creeks, as a result of longwall mining (and subsequent subsidence) under these streams. This indirect impact could contribute sedimentation to the stream, if subsidence resulted in landslides in these drainages. Soil input to the stream also could impede flow or change the channel configuration. Aquatic habitat could be dominated by pools or ponds in areas where subsidence occurs or where large amounts of soil/rock enter the channels.

3.10.3.4 Effects of Alternative C

The direct and indirect impacts of Alternative C on aquatic resources would be the same as discussed for Alternative B. Impacts associated with Alternative C also would occur for an additional 2 to 3 years, as the mining period is longer for this alternative.

3.10.3.5 Effects of Alternative D

The direct and indirect impacts of Alternative D on aquatic resources would be the same as discussed for all action alternatives. See Section 3.10.3.3, Effects Common to All Action Alternatives. The duration of impacts would be 2 to 3 years longer than the No-Action scenario and Alternative B. Since special subsidence protection would be required under Terror and Hubbard creeks, and the Curecanti-Rifle 23/345 kV electric transmission line in Alternative D, the potential effects of sedimentation and flow impedance would be less than those discussed for Alternatives B and C.

3.10.4 Cumulative Effects

If one of the action alternatives is selected, cumulative impacts could affect aquatic communities as a result of coal exploration and mining activities, highway upgrade construction, agriculture, and logging. Potential cumulative impacts would consist of short-term, localized increases in sediment and additional water depletions (primarily related to agricultural operations). The extent of the sedimentation impacts would depend upon the effectiveness of the sediment control practices, presence of drainages near the construction area, and distance to perennial streams. New additional water withdrawals could adversely affect aquatic habitat, if they occur during the low flow periods in the summer, fall, and winter months. Aquatic habitat presently is limited in the local streams in the project area due to agricultural uses. Fuel spills also could occur, if vehicles and equipment are used near water bodies. By implementing restrictions on fueling vehicles and equipment near water bodies, potential spill risks would be reduced.

The effect on aquatic resources and fisheries of increasing production on the Elk Creek Coal Lease Tract to 6 million tons per year would be slightly higher given probable increase of water use (water depletion) for the mining activities.

3.10.5 Potential Aquatic Resources/Fisheries Mitigation and Monitoring

Mitigation measures for fisheries, hydrologic balance, and spill prevention and hazardous materials would be employed. These measures would focus on maintaining acceptable water quantity and quality conditions in project area streams to protect aquatic communities. Sediment control measures would be required. The Spill Prevention Control and Countermeasures (SPCC) Plan would describe measures to be implemented to reduce impacts of potential spills or leaks on aquatic communities.

The unsuitability criterion 9 requires consultation with U.S. Fish and Wildlife Service prior to leasing lands. See Section 1.6.1, BLM Resource Management Plan Consistency; *Appendix C, Unsuitability Analysis Report - Iron Point Coal Lease Tract*; and *Appendix D, Unsuitability Analysis Report - Elk Creek Coal Lease Tract.*

Two additional effective protection measures are recommended for aquatic resources, as set forth in *Table 3.10-4, Potential Mitigation and Monitoring Measures for Aquatic Resources/Fisheries.*

Table 3.10-4
Potential Mitigation and Monitoring Measures for Aquatic Resources/Fisheries

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
AR-1[3]	Contamination of streams and wetlands.	Prohibit fueling and lubrication of vehicles within 100 feet of streams or wetlands. Also, prohibit fuel storage within 500 feet of any water bodies.	1-2	Mining Company Forest Service BLM Colorado DMG EPA Colorado DPHE
AR-2	Decline in target fish species habitat and populations.	Contribute to the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River, as necessary.	1	Mining Company USFWS

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

AR-1 - No fueling or lubricating of vehicles and other construction equipment should be allowed within 100 feet of streams or wetlands. In addition, fuel should not be stored within 500 feet of any water bodies.

AR-2 - The *Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River* (Recovery Program) was established in 1988 to mitigate for water depletion impacts to federally-listed fish species. To ensure the survival and recovery of the listed species, water users may be required to make a payment to the Recovery Program. The payment would be required if any single incremental withdrawal volume exceeds 100 acre-feet (annual average). In 1995, an intra-US Fish and Wildlife Service Biological Opinion determined that the fee for depletions of less than 100 acre-feet is no longer required (USFWS, 1995).

3.11 CULTURAL RESOURCES

Issue: *Identify cultural resources and minimize disturbance impacts to these resources. Areas of concern include the effects to historic properties listed or eligible for listing on the National Register of Historic Places.*

3.11.1 Introduction

The project area for the cultural review in this EIS includes the lands contained within and surrounding the coal exploration license and coal lease boundaries.

3.11.2 Affected Environment

3.11.2.1 Cultural Context

Radiocarbon dates obtained from archaeological sites throughout west-central Colcrado indicate a nearly continuous aboriginal occupation of this area over the past 10,000 years. The RP3 prehistoric context (Reed, 1984) applicable to the project area of potential effects (APE) presents the prehistory of this area in four cultural units or stages. These are the Paleo-Indian Stage (10,000-550 B.C.), the Archaic Stage (5500 B.C. - 500 A.D.), the Formative Stage (500 A.D.-1200 A.D.), and the Proto-Historic/Historic Stage and Ute Tradition (1200 A.D.-1881 A.D.)

The Paleo-Indian Stage is characterized by the hunting of Pleistocene megafauna and the use of large, lanceolate projectile points. This stage is represented in this general region by surface finds of Clovis, Folsom, Hell Gap/Agate Basin, Cody Complex, James Allen points, and others.

The Archaic stage in this region is characterized by the transition from a primarily nomadic, hunting-based subsistence to a hunting-gathering/semi-sedentary subsistence. This stage is represented by various stemmed and side and corner-notched projectile point types, including McKean, Pelican lake, Mount Albion Complex, and others. The remains of such structures as pithouses and wickiups, and storage cists, are also associated with this stage.

The Formative stage is represented in this region predominantly by the Fremont culture, which is characterized by a hunting/gathering subsistence supplemented by maize horticulture. Projectile point types reflect a transition to smaller, notched types, e.g. the Uinta Side-notched. The Fremont culture is also associated with basketry, rock art, and distinctive ceramics, e.g. Uinta Gray Ware.

The Prehistoric/Historic Stage in this region is dominated by the Ute Tradition, which is identifiable as early as 1200-1300 A.D. It is characterized by ceramics, e.g. Uncompahgre Brownware, small, tri-notched or side-notched, concave-based projectile points e.g. Desert Side-notched, and distinctive rock art. The remains of tipis and wickiups are associated with the latter portion (ca. 1800's A.D.) of this stage.

The RP3 historic context for this region (Husband, 1984) presents the Euroamerican history of this area in terms of a number of socioeconomic themes. Themes most applicable to the current project area include Early Exploration and Fur Trade (1760-1876), Ute-Euroamerican Contact (1640-1889), Ranching/Farming (1870-1945), Railroading (1871-1934), and especially Coal Mining (1872-1945).

To date, more than 260 sites and 270 isolated artifacts, representing all four of the prehistoric stages outlined above, have been recorded in Delta County (Office of Archaeology and Historic Preservation, 1996). Also, more than 320 historic sites have been recorded in Delta County.

The historic coal mining theme is prominently represented in the project area by the King Mine site, 5DT1053, and the associated Bowie townsite, 5DT122. These sites are both located outside of, but near the southern boundary of the APE, and have extensive histories dating from the turn-of-the-century era.

3.11.2.2 Files Search

A computerized search of the Colorado Inventory of Cultural Resources was conducted through the Colorado State Historic Preservation Office (SHPO) on April 29, 1999. Additionally, cultural resource records on file at the BLM Uncompahgre Field Office in Montrose were researched on September 30, 1999. The BLM and SHPO research indicated that a number of cultural resource inventories have been conducted within and adjacent to the project APE, and some cultural resources have been recorded in this area.

3.11.2.3 Previous Surveys

Records indicate that a total of 18 cultural resource surveys have been conducted previously within or partially within the current project area of potential effects. These surveys were conducted to ensure National Historic Preservation Act compliance for various projects, (e.g., coal mining/drilling, access roads, timber sales, a borrow pit, pipeline, transmission line, and roller chop/oakbrush control).

These surveys were conducted between 1977 and 1998 by various entities, including Grand Mesa, Uncompahgre, Gunnison National Forest, Colorado State University, and five regional private archaeological consulting firms. Most of these surveys were completed to intensive standards (Class III, although the comparatively recent Bowie No. 2 Mine survey (Connor, 1995) combined intensive and reconnaissance (Class II) survey methods.

Most of the previous surveys were relatively small, ranging from a few acres to about 50 acres in extent, although the Bowie No. 2 Mine survey contained over 800 acres. While most of the total acreage covered by previous surveys is apparently outside the current project area of potential effects, surveys have been conducted in portions of 17 of the 25 sections containing the project area of potential effects. An estimated 25 percent or less of the total acreage within the project APE has been previously surveyed, mostly in the northern and western portions of the APE.

3.11.2.4 Previously-Recorded Cultural Resources

SHPO and BLM records indicate 17 cultural resources have been recorded surficially within the 25 sections containing the current project APE. Some of these resources are referred to in this document by Smithsonian number; however, as directed by Colorado SHPO staff, their exact locations are not described or mapped in this document, as this information is already on file with the SHPO, Forest Service, and BLM.

Most of these 17 resources are located near the extreme western periphery of the project area, generally within the East Fork of Terror Creek drainage. This distribution apparently reflects previous survey activity in this area, and is not necessarily indicative of a similar cultural resource distributional pattern within the unsurveyed portions of the project area of potential effects.

However, the occurrence of both prehistoric and historic cultural resources along Terror Creek and its tributaries does suggest this area has been used for some time, possibly because of its relative accessibility. Recorded prehistoric sites in this area indicate it was used as a source of floral/faunal subsistence resources and for open campsites, while the recorded historic sites are related mostly to ranching/grazing uses.

In addition to these uses, Terror Creek and the other two major drainages within the project APE, Hubbard Creek and Bear Creek, all presumably served prehistorically and historically as travel routes between the North Fork of the Gunnison River Valley and the higher elevations to the north.

There are also unrecorded sites within these drainages, including several mining-related sites shown on the USGS Quadrangles, and the Dove Cave site. The latter is in Dove Gulch, a tributary of Hubbard Creek. It reportedly is a rock overhang used as a residence in the 1930's-40's era by a local recluse, Reuben Dove, for whom the gulch was named.

The 17 recorded resources within the project sections consist of eight isolated prehistoric lithic artifacts, three prehistoric open campsites, one non-cultural rock overhang recorded as a "possible" prehistoric rockshelter, two historic corrals, one historic dugout, one historic cabin, and one historic dumpsite.

The isolated artifacts consist of lithic reduction debris, utilized flakes, bifaces, a handstone, one fragmentary Late Archaic projectile point, and one fragmentary Late Prehistoric projectile point.

Of the 17 previously-recorded cultural resources, seven are inside the boundaries of the project APE. One of these is the isolated Late Prehistoric projectile point fragment noted above, 5DT163. Of the remaining six resources, three are open lithic sites 5DT272, 5DT273, and 5DT868, 1 is the non-cultural rock overhang in the BLM records, one is an historic cabin in the BLM records, 5DT698 (Hughes Cow Camp), and one is an historic dugout, 5DT699. Two of the seven cultural resources within the project APE, 5DT273 and 5DT700, are in the "Needs Data" category for NRHP evaluation, while the other five have all been field evaluated and/or officially determined not eligible for the NRHP.

3.11.2.5 Cultural Resource Potential Within Area of Potential Effects

Based on the published prehistoric and historic cultural contexts for this general region and the project-specific SHPO files search data, the project area can be presumed to have some potential for surficial cultural resources associated with any/all of the prehistoric periods and historic themes described above.

Previous survey data in the project area are insufficient to accurately predict the potential for cultural resources at any given location within the APE. However, the APE does contain various natural environmental elements which have been associated with prehistoric cultural resources elsewhere in this general region. These include the major tributary canyons, which provide accessibility and reliable water sources, numerous cliff faces and rock overhangs which are potential sites for rock art and rock shelters, and pinyon/juniper and other vegetative communities which provide subsistence resources.

The Terror Creek, Hubbard Creek, and Bear Creek drainages may be the most potential for significant prehistoric cultural resources, especially in the relatively lower-lying areas near rock overhangs and permanent water sources. By contrast, the lowest potential for prehistoric cultural resources might be anticipated for the steep, barren upland areas away from these drainages.

Historic cultural resources for which most potential within the APE could probably be anticipated would be those related to grazing uses and especially, the coal mining theme. Historic sites are probably most likely to occur in relatively accessible areas, e.g. the three major canyons noted above. Areas with surface or near-surface coal deposits have potential for mining-related sites.

The file search produced some direct evidence of an Aboriginal presence in and adjacent to the project area during the Late Archaic and Late Prehistoric stages. Other prehistoric cultural resources are likely to exist within the project area, although the minimal previous survey data available preclude accurate prediction of their locations. If present, such resources could be useful in elucidating general patterns of prehistoric settlement/subsistence on the eastern portion of the Colorado Plateau, and might also provide chronological information leading to the establishment of absolute date/artifact associations in this region.

Historic cultural resources for which most potential within the project area could probably be anticipated would be those related to the coal mining theme. The historic King Mine site, 5DT1053, and the associated Bowie townsite, 5DT122, both located outside of, but near the southern boundary of the project area, have extensive histories dating from the turn-of-the-century era.

3.11.3 Environmental Consequences

As indicated elsewhere in this EIS, surface subsidence and ground clearing for exploration drilling resulting from the expansion of underground mining are the only anticipated surface

effect within the project area at this time. The amount of subsidence is expected to be visually undetectable throughout most areas, although some cliff faces and rock overhangs could eventually collapse as a result of subsidence. Currently unsurveyed cultural resources associated with rock overhangs could be adversely affected if overhangs collapse. Sometime in the indeterminate future, visible surface impacts may be created by exploratory drilling and possible construction of mine ventilation shafts and degasification boreholes. The locations of these potential future impacts within the project area are not known at this time.

It appears that none of the few known cultural resources within the area of potential effects would be discernibly affected from subsidence. The one possible exception identified at this time is Dove Cave. That is within the Iron Point Lease Tract and Exploration License area. As indicated above, of the seven previously-recorded cultural resources within the project area of potential effects, 5DT273 and 5DT700, are listed in the "Needs Data" category in SHPO records. Resources in this category have been regarded as potentially eligible for the National Register of Historic Places until evaluated otherwise. As indicated earlier, all other known cultural resources within the area of potential effects are apparently not eligible for the National Register of Historic Places.

The Bowie townsite, 5DT122, and the King Mine, 5DT1053, have both been officially determined eligible for the National Register of Historic Places. Both of these sites are outside of, but near the southern area of potential effects boundary of the project area. No impacts to these sites are expected from the exploration or mining.

There would be no anticipated cumulative impact to cultural resources.

3.11.4 Native American Consultation

A project description and vicinity map were sent to Betsy Chapoose, Director, Cultural Rights and Protection, Northern Ute Tribe, upon initiation of the NEPA process. No comments have been received concerning the project.

3.11.5 Management Recommendations

The historic site Dove Cave would be protected from surface disturbance including damage from subsidence (see *Appendix I, Forest Service Stipulations, Iron Point Coal Lease Tract.*) Prior to any surface impacts (e.g. potential collapse of rock overhangs, drilling, portal construction, etc. as described above), intensive survey of the previously-unsurveyed areas with potential for cultural resources is recommended. Recordation and evaluation of the Dove Cave site is required if it is subjected to any future surface impacts, including potential subsidence. Since it appears that no other cultural resources would be affected by the proposed expansion of underground mining, no further evaluative or protective cultural resource measures are recommended at this time.

However, prior to any surface impacts (i.e., drilling, shaft construction, etc.) described above, a cultural survey of the areas to be affected is required. Also, if the Bowie townsite and/or King Mine, 5DT122 and 5DT1053, are to be impacted by federally-permitted action in the future, agency consultation to mitigate or minimize adverse effects to these properties is required. All eligible sites would be mitigated according to plans approved by the surface management agency and SHPO.

Management actions for undertakings potentially affecting cultural resources on the BLM portions of this project will comply with the1998 State Protocol Agreement Between the Colorado State Director of the Bureau of Land Management and the Colorado State Historic

Preservation Officer, as well as the 1997 Programmatic Agreement Among the Bureau of Land Management, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers.

3.11.6 Potential Cultural Mitigation and Monitoring

The mitigation and monitoring measures for cultural resources are set forth in *Table 3.11-1, Potential mitigation and Monitoring measures for Cultural Resources.*

Table 3.11-1
Potential Mitigation and Monitoring Measures for Cultural Resources

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
C-1[3]	Disturbance or loss of cultural resource information.	Class III survey.	1	Forest Service BLM SHPO
C-2	Impacts to Bowie townsite or the King Mine.	Agency consultation.	1	Forest Service BLM SHPO

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

C-1 - Prior to any visible surface impacts (eg., potential collapse of rock overhangs due to subsidence, drilling, portal construction, etc.), a Class III survey of previously unsurveyed areas with potential for cultural resources is required. This includes the recordation of Dove Cove. This survey work would be effective in determining the presence of any cultural resources and recommendations for any protection required.

C-2 - If the historic Bowie and/or King mines are to be impacted, agency consultation would be effective to mitigate or minimize any adverse effects to these properties.

3.12 NOISE

Issue: *Identify and minimize noise impacts. Areas of concern include: levels of noise from coal transportation by truck and railroad; disruptions caused by noise to the normal activities of adjacent residents/communities; and nighttime railroad noise in Paonia, Hotchkiss, and Delta.*

3.12.1 Introduction

This section provides an overview of noise impacts associated with the pending decisions on the coal exploration license and lease applications. Background information on noise is set forth in *Appendix N, Noise.*

Environmental noise is typically measured in A-weighted decibels (dBA). The A-weight is automatically computed by noise meters and is a frequency-dependent sound level adjustment that simulates sensitivity of human hearing at various sound frequencies. See *Figure 25, Noise Levels Caused by Typical Activities*; this figure illustrates noise levels generated by familiar operations.

The federal Department of Transportation and its sub-agency, the Federal Transit Administration, have established non-binding guidelines to define unacceptable noise impacts in EIS documents that involve federally-funded highway, railroad, and airport projects. Because federal funding is not involved with the North Fork Coal EIS, these guidelines do not directly apply to this EIS, but they establish a set of criteria to define noise descriptors. See *Figure 26, Federal Transit Administration Noise Impact Criteria for Highway Traffic and Railroad Projects*. Also see *Appendix N, Noise*, for further information on these criteria.

Because decibels are measured on a logarithmic scale, a doubling of the sound pressure corresponds to a noise increase of 3 dBA. For example, a single bulldozer typically produces a sound level of about 80 dBA at a distance of 50 feet from the bulldozer. Two identical bulldozers working side by side would give a noise reading of 83 dBA, and this noise would be perceived as barely louder than one bulldozer. Ten bulldozers side by side would give a noise reading of 90 dBA, and that would be perceived as twice as loud as a single bulldozer.

There are many factors that determine whether an increase in the noise level above the existing background is "audible." The most important factor is the nature of the new noise source as compared to the nature of the background noise. In the case of noise generated from industrial sites such as mining, or the noise generated from coal truck and/or train traffic, this noise would be different from rural background sounds, so relatively small increases in such noise levels caused by mechanical equipment would be noticeable. For example, the noise generated from exploratory equipment operating in an unpopulated area would be noticeable even when the equipment causes noise increases as low as 2 dBA.

3.12.2 Affected Environment

Background noise level measurements at representative locations around the project site were taken on April 21, 1999 and April 23, 1999. The measurements were taken using a hand-held noise monitor (Larson-Davis Model 720) that was set for A-weighting and "slow" response. The monitor has a detection range of about 25 dBA to 120 dBA. The weather conditions during the noise monitoring were cool with little wind.

Measurements in Paonia and Hotchkiss were taken during a period when there were no mine related trucks or trains. Rural background measurements were taken during the daytime and nighttime at two locations on Garvin Mesa and at one location next to State Highway 133. Some of the monitoring points in Paonia and Hotchkiss were later used to measure noise levels caused by passing trains.

In general, the background noise measurements were as expected. The quietest measurements taken at night on Garvin Mesa were 36 dBA, with the predominant noise levels being natural bird sounds. Routine daytime noise levels in the Paonia and Hotchkiss residential areas were 48 to 56 dBA with predominant sounds produced by routine local traffic. At the rural site near State Highway 133, measurements showed 41 to 49 dBA during brief periods of no discernible traffic, and spot noise levels of 64 dBA while a coal truck passed.

Noise levels during passing trains at sites in Paonia and Hotchkiss registered noise levels ranging from 51dBA, for a westbound train, at a point 550 feet from the tracks, to 100 dBA for an eastbound train in Paonia approximately 30 feet from the tracks. Train whistle noises measured 110 dBA at a point 30 feet from the tracks in Paonia and 106 dBA in Hotchkiss at a point 40 feet from the tracks.

The noise measurement locations and summaries of the measured noise levels are shown on the following figures found in the EIS figure volume:

- *Figure 27, Train Noise at Paonia (4-21-99);*
- *Figure 28, Train Noise at Paonia (4-23-99);*
- *Figure 29, Train Noise at Hotchkiss (4-21-99 and 4-23-99).*

3.12.3 Environmental Consequences

Noise has historically been recognized as a health hazard with the potential for causing hearing damage. Efforts by industry and regulatory actions have lessened the likelihood for hearing damage occurrence. For example, the U.S. Mine Safety and Health Administration (MSHA) imposes noise standards on coal mining operations for worker hearing protection.

A secondary impact associated with noise is the nuisance effects of noise that include interference with speech, psychologically unsettling environment at home and work, and more specific problems such as sleep disruption. The extent of these effects varies, sometime significantly, between individuals and as a factor of the noise source.

The noise characteristics which affect the listener's response include overall loudness, sound pressure level, duration of exposure, time distribution of occurrence, and sound frequency. Other factors include the listener's total exposure, age, and individual susceptibility.

3.12.3.1 Effects of Alternative A (No-Action)

Since the issuance of the Draft EIS, Bowie has applied for approval from the Colorado DMG to operate at an annual production rate of 5 million tons of coal. Likewise, Oxbow is permitted by these agencies for a similar annual production rate. Therefore, the discussion of noise for the No-Action Alternative would be the same as for the action alternatives. See Section 3.12.3.2, Affects Common to All Alternatives.

3.12.3.2 Effects Common to All Alternatives

The focus of the noise analysis is centered on the mining and transportation activities for coal operations in the North Fork of the Gunnison River Valley.

Typically, the noise emissions as a result of the operation of the surface facilities for the underground mines are not expected to be a general nuisance to nearby towns and residents. The major noise nuisances associated with these mines would result from truck and railroad transportation of coal; these impacts are expected to occur on a more frequent basis with future coal production increasing from 1998 levels to the presently permitted coal production rates for valley mines.

Noise Impacts From Exploration Activities - Exploration drilling in the Iron Point Exploration License would generate some noise; however, this noise would not create any nuisances to the nearest homes in the North Fork Valley or to the towns of Paonia or Somerset. Noise impacts would also be of limited duration.

Noise Impacts From Surface Facilities - Noise from routine mining activities at the surface facilities of Bowie and Oxbow would not create any unacceptable noise levels at the nearest homes. Measurements of noise levels near surface facilities of these mines showed that ambient noise levels are low. Noise levels taken at the valley floor beneath the Bowie No. 2 Mine surface facilities ranged from 39 to 46 dBA and were scarcely discernible above background noise. Noise readings taken by Oxbow at homes nearest their surface operation at Somerset ranged from 55 to 61 dBA, but those noise readings were dominated by public traffic.

Ventilation fans would generate a "white noise" sound that would be barely discernible at a distance of 3 to 4 miles. The new "intake" ventilation fan installed at the Bowie No. 2 Mine in late 1999 is quieter than the old "exhaust" fan that operated previously. Oxbow plans to install a new ventilation fan for the Elk Creek portal, but it is unlikely that this new ventilation fan would be discernible at homes in Somerset since it will be farther distant than the current Sanborn Mine fan.

Under certain meteorological conditions with quiet background, it is possible that noise from the surface facilities of the Bowie No. 2 Mine could be audible at Garvin Mesa, approximately 2 miles west of the surface facilities. Under certain conditions, the noise could be perceptible as a nuisance. Generally, however, environmental impacts of that relatively quiet noise would be minor. Most of the noise from the surface facilities at the Bowie No. 2 Mine would be blocked by a pronounced ridge west of the facility.

Noise Impacts From Train Loading Operations **-** Noise readings conducted on October 29, 1999 by Air Sciences, Inc. (under contract to Oxbow) at the Oxbow train loading facility at Somerset indicated that the train loading operation complied with Colorado noise statutes. Noise readings taken on Garvin Mesa near the Bowie No. 1 Loadout showed that the facility also complies with the Colorado noise statutes at the facility boundary. See *Appendix N, Noise.*

Noise Impacts From Train Whistles **-** Federal train safety laws require trains crossing public roads to sound their whistles at least once within a quarter mile of each public grade crossing. Whistles blown an estimated 100 feet from the public crossing would be expected to exceed noise levels of 100 dBA, as measured as L-max, which is the loudest 1 second sound level during any specified period. Train whistles sounded at night would exceed the Colorado statutes that limit the L-max noise level to 75 dBA at the edge of the railroad right-of-way. It is unclear which regulation takes precedence: the federal law requiring the train to sound its whistle, or the Colorado noise statute which restricts the loud noise caused by the whistle.

Informal observations of whistle noise (those with no electronic noise readings) were made from County Road 4175 at the base of Garvin Mesa, about 1 mile from the train whistle. The observations were made during the pre-dawn hours of April 23, 1999 during calm conditions when the background noise level was about 36 dBA. The whistle was clearly audible above the quiet background.

Noise Impacts From Coal Trains (Excluding Whistles) **-** Noise measurements showed that train noise (excluding whistles) varied considerably depending on the speed of the train, the distance from the track, and the presence of buildings between the tracks and the receiver. Generally, noise from a fast-moving train would be much higher than noise from a slow-moving train. For example, the noise from one westbound train moving through Paonia, at a speed of approximately 10 miles per hour, was estimated to have an L-eq noise level of 61 dBA and an L-max level of 68 dBA, with the noise receiver approximately 125 feet from the tracks. A train moving approximately 15 miles per hour through Hotchkiss, would have an L-eq level of approximately 79 dBA and an L-max level of 90 dBA at a distance of 125 feet.

With regard to passing train noise, the following comments are made:

- Homes near the railroad tracks without intervening buildings between them and the tracks would be subject to a severe impact.

- Homes more than about one block from the railroad tracks that are partially shielded by adjacent buildings would be subjected to noise levels above non-train background levels, but the noise levels would not be considered severe.

- Homes more than about two blocks from the railroad tracks that are shielded by intervening buildings would perceive noise levels during the daytime that would be only slightly higher than the background levels. Although the noise from passing trains would be audible during quiet nighttime periods, the noise of passing trains (excluding whistles) would not be expected to disrupt sleep or normal speech of individuals living more than two blocks from the railroad tracks under most conditions.

***Noise Impacts From Coal Trucks* -** Coal truck traffic on State Highway 133 can cause noise impacts to homes within 200 feet of the highway. Within 100 feet of the highway right-of-way, homes would experience a severe impact. Such noise levels would be more predominant at nighttime, when background noise levels are lower.

3.12.4 Cumulative Impacts

Noise from the surface facilities of the West Elk Mine, operated by Mountain Coal, would not be expected to add cumulatively to noise nuisance impacts. However, the transportation of coal from the West Elk Mine would add cumulative noise nuisance impacts. The principal cause would be from the rail transport of coal from the underground mine operation east of Somerset, as coal trains shipping with West Elk Coal pass through the communities of Somerset, Paonia, Hotchkiss, and Delta.

The effect of increasing production on the Elk Creek Coal Lease Tract to 6 million tons per year would be an increase in noise impacts, primarily from the rail transportation of coal.

3.12.5 Potential Noise Mitigation and Monitoring

The mitigation and monitoring measures for noise are set forth in *Table 3.12-1, Potential Mitigation and Monitoring Measures for Noise.*

Table 3.12-1
Potential Mitigation and Monitoring Measures for Noise

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
N-1[3]	More detailed understanding of noise impacts in general, particularly train whistle noise near public grade crossings in towns.	Conduct additional noise monitoring.	4	??
N-2	Reduce train noise through populated areas	Reduce train speed	2-3	Union Pacific
N-3	Reduce train noise to individual homes	Install improvements such as double-pane windows	1-2	Private Homeowners
N-4	Reduce train noise to nearby residences and businesses	Install noise walls	1-2	Private Homeowners Union Pacific
N-5	Reduce or eliminate coal train whistle noise	Close grade crossings; relocate road; build overpasses/ underpasses for grade separation	1	Uncertain due to conflicting laws

Table 3.12-1 Potential Mitigation and Monitoring Measures for Noise				
Code	**Impacts Mitigated**	**Potential Mitigation and Monitoring**	**Effectiveness[1]**	**Who[2]**
N-6	Reduce coal truck traffic noise to homes along State Highway 133	Reduce truck speed	2-3	Mining Company
N-7	Reduce coal truck traffic noise to homes along State Highway 133 between Bowie No. 2 Mine and Bowie No. 1 Loadout	Construct new train loadout adjacent to Bowie No. 2 Mine	1	Mining Company
N-8[3]	Reduce noise impacts from increased rail traffic	Establish a 5 million ton of coal per year cap for Bowie	3	NFCWG
N-9[3]	Reduce surface operation noise impacts to nearby residences	Install baffling or housing around ventilation fans, high-grade precision sealed bearings for conveyor rollers, etc.	1-2	NFCWG

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point Coal Lease tracts, respectively.

N-1 - Additional noise readings and surveys could be undertaken to assess the L-max noise level of train whistles at numerous locations near highway grade crossings. In addition, additional noise readings could be made to confirm the effectiveness of reducing train speed as a noise mitigation measure. As part of this additional survey work, an inventory of homes and businesses near each grade crossing in Delta County could be made to assess how many homes are currently severely impacted by train whistles and passing trains. This survey work would provide additional data, but the overall conclusions from additional survey work would probably confirm the EIS noise assessment.

N-2 -Coal trains passing through populated areas could be slowed down to reduce the power load on the locomotive and thus probably reduce the noise. It was observed that west bound trains traveling slightly downhill (with a low engine load) were quieter than east bound trains traveling slightly uphill (with a high engine load).

N-3 - Noise mitigation could be applied directly to homes that are adjacent to the railroad tracks. Improvements such as double-pane windows have proven to be effective in reducing noise impacts near highways and airports. These improvements are very effective when the windows are closed, but they are ineffective if the windows are open on warm days.

N-4 - Noise walls could be installed at locations where trains and coal trucks pass close to homes. Noise walls would prove highly effective, but are highly localized noise reductions. Careful consideration must be given to potential traffic safety concerns that would be created if noise walls reduced visibility at railroad grade crossings or to the highway.

N-5 - The noise from coal train whistles is most pronounced immediately in front of the train. Noise impacts to homes next to tracks at grade crossings could be eliminated if crossings are closed. Additionally, grade separation could be achieved by constructing overpasses or underpasses.

N-6 - The speed of the coal trucks could be reduced. The noise modeling was completed using the posted speed limit of 55 miles per hour. Reducing the allowable speed of the coal trucks would reduce the noise impacts.

N-7 - Relocation of the Bowie No. 1 Loadout to a new location adjacent to the Bowie No. 2 Mine would eliminate noise impacts that are currently caused by coal trucks traveling on State Highway 133 between the two facilities. Relocating the train loadout would also eliminate the current minor noise effects to homes on Garvin Mesa close to the present Bowie No. 1 Loadout. However, the noise from a new loadout at the Bowie No. 2 Mine could increase noise levels to a small number of homes within 1 mile of the new location.

3.12.6 Potential Future Noise Mitigation

The Federal Railroad Administration (FRA) is working to establish regulatory exemptions to the use of locomotive horns at all U.S. public highway-rail grade crossings. Current regulations require that a locomotive horn be sounded while each train is approaching and entering upon each public highway-rail grade crossing. The proposed new rule contains provisions that set a maximum sound level for locomotive horns, limit sound directed to the side, prescribe when and how to sound the horn, and provide an opportunity to any community in the nation to establish a quiet zone.

As part of the regulatory process, the FRA prepared a draft environmental impact statement to evaluate the proposed rule's potential for environmental impact. The FRA is making their Draft EIS and "notice of proposed rule-making" available for public comment until May 26, 2000. More information can be found on the FRA's web site at hhtp://www.fra.dot.gov/horns.

3.13 LAND USE

Issue: *Minimize disturbance. Areas of concern include: the acreage of disturbance; the amount of disturbance on BLM, Forest Service, and private lands; and the possible changes in future land use.*

3.13.1 Introduction

Dominant land uses within the region are mining, exploration, agriculture, logging, residential development, and recreation. Specifics about land use within and adjacent to the two coal lease tracts are set forth in Section 1.9, Past, Present and Reasonably Foreseeable Cumulative Actions Considered in this Analysis.

Mixed land ownership occurs within and around the two coal lease tracts and the exploration license area as follows: 59 percent Forest Service, 25 percent BLM, and 15 percent Private.

3.13.2 Affected Environment

This section describes the various land uses within and surrounding the two coal lease tracts and the exploration license area.

3.13.2.1 Private and Public Lands

There is a mixture of federal and private lands within the two coal lease tracts. Private land, as well as those lands administered by the BLM and the Forest Service are shown on *Figure 2, Surface Ownership Map*. All coal within the two coal lease tracts and the coal exploration

license area is federally controlled.

3.13.2.2 Past and Present Mining Operations

Coal mining has been one of the dominant land uses in the North Fork of the Gunnison River area. Underground mining has occurred in this area for the past 100 years. Coal mining has occurred on both private and public lands in the general area. The location of the historic coal mining operations are shown on *Figure 3, Historic Coal Mines and Federal Coal Lease Locations*. For more information on the historic mining in this area, see *Appendix G, Historic Coal Mining Activity*.

There are currently three existing operating and one idle underground coal mines in the North Fork Valley. These are the Bowie No. 2 Mine, the Sanborn Creek Mine, and the West Elk Mine.

The Bowie No. 2 Mine is operated by Bowie Resources Ltd. and is presently conducting coal mining operations using room-and-pillar mining techniques. Bowie plans to add a longwall system in 1999 which would increase production to 5 million tons per year.

The Sanborn Creek Mine is operated by Oxbow Mining, Inc. In 1998, the Sanborn Creek Mine produced approximately 1.5 million tons of coal. The mine is permitted with the Colorado DMG for an annual production of approximately 4 million tons of coal per year, but has the capacity to produce up to 6 million tons of coal per year.

The West Elk Mine is operated by Mountain Coal Company and presently produces coal from several federal leases. This operation utilizes a longwall system. In 1999, Mountain Coal Company plans to produce and ship approximately 7 million tons of coal from the West Elk Mine. In 2005, production from the West Elk Mine is slated to reach 8.2 million tons of coal per year.

The Bowie No. 1 Mine is currently idle under provisions of a temporary cessation approval from the Colorado DMG. There was no coal production from this mining operation in 1998.

3.13.2.3 Coal Exploration

Coal exploration has been initiated in the area in conjunction with actual coal mining operations. Such exploration activities have been undertaken to identify and delineate recoverable coal deposits. These activities generally involve drilling to delineate the coal reserves and evaluate coal quality. Exploration activities have occurred on National Forest System lands and BLM-administered lands under plans of operation and subsequent amendments approved by the BLM and the Forest Service. There has also been coal exploration on private lands. All exploration activities, whether on federal or private lands, must be permitted with the Colorado DMG. Other than the coal exploration license currently under review, there are no exploration activities presently planned or ongoing on the Iron Point or Elk Creek Coal Lease tracts.

3.13.2.4 Utilities

The Western Area Power Administration owns and operates the Curecanti-Rifle 230/345 kV electric transmission line that essentially parallels Terror Creek, west of the Bowie No. 2 Mine. The right-of-way for this transmission line is 125 feet in width, including access roads. The transmission line structures are steel lattice with buried reinforced concrete bases.

The electric transmission line would be protected from mining impacts as stated in Criterion 2 in *Appendix C, Unsuitability Analysis Report - Iron Point Coal Lease Tract*.

3.13.2.5 Timber Operations

The major timber harvest activities in the region have occurred in the Steven's Gulch area, which is 2 to 3 miles to the west of the proposed Iron Point Coal Lease Tract. Future large timber sales are not being planned in this area. Very small timber sales may occur in the analysis area for the harvest of fence posts and fuel wood. These sales are generally very limited and scattered in nature. Further discussion of timber operations is given in Section 3.5.2.2, Project Area Surface Water Hydrology, and Section 3.7.3.2, Effects Common to All Alternatives. In total, the timber sales over the past 20 years in the Terror Creek and Hubbard Creek watersheds have affected approximately 2 percent of the watershed area. These sales have been completed, with the exception of several small partial cut units within the Hubbard No. 2 Sale. The Forest Service expects that small timber sales would occur in the future, but no major timber sales are planned.

The Hotchkiss Ranch Company has harvested several aspen stands on their property which is located within and surrounding the Elk Creek Coal Lease Tract. This logging has occurred in the Bear Creek drainages.

3.13.2.6 Oil and Gas

Refer to Section 3.3.2.3, Other Geologic Resources.

3.13.2.7 Agricultural Activities

Agricultural activities have historically been, and continue to be, a prominent part of the local Paonia economy. Fruit production is generally confined to the valley floors and low mesas/terraces adjacent to the North Fork of the Gunnison River. The principal orchard crops are apples, pears, peaches, and cherries. In recent years, vineyards (and several wineries) have been developed and are being operated in the Paonia area.

Sheep and cattle grazing also occur on pasture land in the Paonia area, with summer livestock grazing occurring in the higher elevations within and adjacent to lands in the proposed Iron Point and Elk Creek Coal Lease tracts. Some pasture lands have been used for hay production.

3.13.2.8 Residential Activities

In recent years, the area within and surrounding the communities of Paonia, Hotchkiss, Crawford, and Delta, Colorado have experienced an influx of population and the construction of new housing. This region of Colorado seems to be attractive to new "migrants" because of a number of factors including the area's natural beauty, low land costs, sparse population, minimal land use controls, and the low cost of living. The new housing development is "down valley" from the proposed coal lease tracts and exploration license area. There is no residential housing development planned for either coal lease tract or the exploration license area.

3.13.2.9 Recreation

There are no developed recreation facilities operated by the BLM or the Forest Service on the proposed coal lease tracts or exploration license area. Hunting is the primary recreation activity within and adjacent to these areas. Other dispersed recreational activities occur in the area, but on a limited basis due to the lack of developed facilities. Four-wheeling, hiking, picnicking, horse back riding, snow mobiling, and general sightseeing are all common recreational activities.

3.13.2.10 Roadless Area Review

A portion of the Elk Creek Coal Lease Tract (W½, Section 32, T12S, R90W) falls within a Roadless Area Review and Evaluation (RARE II) area that was inventoried in the late 1970s for the purpose of Wilderness Designation under the Wilderness Act of 1964. The Springhouse Park area (02-184) was not listed as suitable wilderness in the Final RARE II EIS in 1979 (USDA-FS, 1979).

On March 1, 1999, Forest Service Chief Mike Dombeck proposed a moratorium on the construction and reconstruction of roads in Roadless Areas, including RARE II areas on National Forest System lands. The moratorium is in effect for 18 months or until a policy is developed, whichever comes first. If implemented (and depending on the provisions of implementation) the moratorium could postpone or prohibit construction of new roads, or reconstruction of existing roads, that may be used for coal exploration or other coal-related purposes in RARE II areas. The decision(s) in this EIS will comply with the policy in effect at the time of the decision. A lease notice will be attached to each of the leases and license considered in this EIS informing the potential lessee/licensee that lands within the application area are subject to the moratorium (see *Appendix I, Forest Service Stipulations - Iron Point Coal Lease Tract* and *Appendix J, Forest Service Stipulations - Elk Creek Coal Lease Tract*.

On October 13, 1999, President Bill Clinton directed the Forest Service to develop a proposal to protect inventoried roadless areas on National Forests. At the time of preparation of this Final EIS, public scoping on the proposal had been initiated. A final rule is expected by late 2000. The decision(s) based on this EIS will comply with the policy in effect at the time of the decision.

3.13.3 Environmental Consequences

In the long term, following mining, the area would be used much as it was before mining. Any surface subsidence caused by underground mining would be minimal and would not affect the pre-mining land uses. The reclamation and revegetation techniques to be undertaken on any disturbed sites are comparatively simplistic, commonly accepted techniques with a history of successful application in the western states. Reclamation would be initially employed to provide for site stability, with revegetation allowing the disturbed sites to return to conditions that existed prior to any disturbance.

3.13.3.1 Effects Common to All Alternatives

Direct Effects - Mining activities have historically occurred and are currently occurring within and adjacent to the two federal coal lease tracts and the coal exploration license area. The exploration activities and the operation of an underground coal mine would not introduce any noticeable land use changes in the area around the coal lease tracts or the exploration license area. In addition, on a more regional basis, the exploration and mining would not substantially change other land uses in Delta or Gunnison counties, or on Forest lands or BLM-administered lands.

Reclamation of any surface disturbance would be planned to reestablish wildlife habitat and livestock grazing. Past experience in the area has shown that exploration activities have affected grazing management. When exploration activities occur, the vehicle traffic can have a negative impact on livestock management. The traffic can cause cattle to move out of an area; and the noise, dust and commotion can cause cattle to move away. This is a short-term impact and may not be substantial if the exploration area is limited in size, or the time period adjusted to account for the planned grazing period. More significant is the impact of gates being left open. The stock grazing is partially controlled by fences. When fence gates are left open,

stock may move into or out of an area before they should. To maintain control of stock movement, gates must be closed when needed in order to meet grazing management objectives.

New roads associated with coal exploration can also effect grazing management. New roads can help improve livestock distribution, especially in areas of oak brush. However, if new roads are left open to wheeled traffic, the positive effect is often negated by the increase in traffic. This impact can be mitigated by ensuring that all new roads constructed associated with coal exploration are reclaimed and left passable by foot and horse traffic only.

With mitigation and reclamation, the implementation of any of the alternatives would not substantially affect the long-term land use or land use planning on National Forest System lands, BLM-administered lands, or adjacent private areas.

Subsidence would not alter the appearance of any of the area within the two coal lease tracts. Surface disturbances on the coal lease tract and the exploration area would be minimal and temporary, with reclamation returning disturbed areas to a stabilized and productive condition. Preliminary evaluations of other reclamation work in the area indicate that revegetation can be successfully accomplished at the time of closure.

Post-mining land use would be similar for all alternatives. It would include livestock grazing, wildlife habitat, and dispersed recreation.

Indirect Effects - As explained in Section 3.15, Socioeconomics, there may be some minor population increases associated with the expanded mining which may cause some minor changes in private land use within Delta County. Some undeveloped or agricultural land may be converted to residential uses if these incoming workers choose to construct homes in the area. The amount of such development would be minor given the relatively few new comers that would be expected. No effects of mining-induced seismicity are expected on the Curecanti-Rifle 230/345 kV electric transmission line.

3.13.3.2 Effects of Alternative A (No-Action)

If Alternative A is selected, the land use of the two coal lease tracts and the coal exploration area would not change. In this situation, mining and exploration would continue in other areas.

3.13.3.3 Effects of Alternative B, C and D

The land use effects of these three action alternatives would be the same as described in Section 3.13.3.2, Effects Common to All Alternatives.

3.13.4 Cumulative Effects

There are no anticipated major cumulative land use effects expected for any of the alternatives. Mining and exploration, grazing and other agricultural activities, housing development and recreation would probably remain the dominant land uses in the immediate area of the coal lease tracts and the coal exploration area.

The effect on land use of increasing production on the Elk Creek Coal Lease Tract to 6 million tons per year would be minimal.

3.13.5 Potential Land Use Mitigation and Monitoring

The Colorado DMG would require a subsidence mitigation and monitoring as a result of underground mining. See Section 3.3.5, Potential Subsidence Mitigation and Monitoring. In addition, the Colorado DMG, BLM and Forest Service require reclamation of disturbed sites from exploration and mining and would be responsible for evaluating revegetation success which would return any disturbed areas to a condition that existed prior to exploration or mining. The reclamation work on disturbed areas required by these agencies is highly effective. See *Table 3.13-1, Potential Mitigation and Monitoring Measures for Land Use.*

Table 3.13-1
Potential Mitigation and Monitoring Measures for Land Use

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
L-1[3]	Interim use of Highway 133 coal stockpile until Colorado DMG Permit Revision PR-03 is implemented.	Reclaim Highway 133 coal stockpile.	1	NFCWG
L-2[3]	Closure and reclamation of Bowie No. 1 portal facilities.	Reclamation to standards in Colorado DMG Permit C-81-038.	1	NFCWG

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

3.14 TRANSPORTATION

Issue: *Address truck and train traffic impacts created by coal mining in the North Fork of the Gunnison River Valley and the potential for accidents. Areas of concern include: the amount of train traffic in the area; the ability of the railroad to handle the projected tonnages of coal to be mined from the North Fork of the Gunnison River Valley; the increase in traffic as a result of hauling coal to the Bowie No. 1 Loadout and the Terror Creek Loadout; the need for an additional rail loadout facility for the Bowie No. 2 Mine; the potential for accidents involving increased train and truck traffic; and, the risks for accidents at railroad crossings in Delta County as well as along sections of State Highway 133 subject to coal truck traffic.*

3.14.1 Introduction

The transportation analysis focuses on State Highway 133 in the Paonia-Somerset area and the Union Pacific railroad spur from Grand Junction to the loadout at the West Elk Mine. This analysis was based on projected vehicular and train traffic, public safety, environmental safety, and long-term maintenance. The location of the railroad spur and the regional roads are shown on *Figure 31, Rail and Road Systems.*

Highway traffic counts are identified as annual ADT. ADT is defined as the measure of traffic over a 24-hour period and is determined by counting the number of vehicles passing a specific point on a particular point in either direction. The Colorado Department of Transportation has estimated annual 1996 ADT values (the most current available) based on actual traffic counts made at various locations along State Highway 133 and State Highway 92. Annual ADT estimates for 1998, 2000 and 2005 are based on an annual 2 percent increase in traffic volumes, as well as traffic increases expected as a result of expanded mine production. See *Table 3.14-1, Annual Average Daily Traffic - State Highways 92 and 133.*

Table 3.14-1 Annual Average Daily Traffic - State Highways 92 and 133				
	1996[1]	1998[2] (Estimated)	2000[2] (Projected)	2005[2] (Projected)
Highway 92 in Delta, just east of intersection with Highway 50	12,600	13,109	13,604	15,021
Highway 92 in Hotchkiss, just south of intersection with Highway 133	3,050	3,173	3,301	3,644
Highway 92 in Crawford	1,850	1,925	2,003	2,212
Highway 133 in Hotchkiss, just east of intersection with Highway 92	5,400	5,618	5,845	6,454
Highway 133 in Paonia, just east of intersection with Highway 187	3,150	3,277[3] 3,541[4]	3,410[3] 4,348[5]	3,765[3] 4,703[5]
Highway 133 just east of Somerset	2,000	2,081	2,165	2,390
Highway 133, at base of McClure Pass, just south of road to Marble	1,050	1,102	1,146	1,265
Highway 133, just south of Redstone	1,650	1,717	1,786	1,972

Note:
1. 1996 data provided by Colorado Department of Transportation; this is the last year for which Colorado Department of Transportation has summarized ADT estimates.
2. Assume 2% increase per year, approximately equal to average growth rate for Delta/Gunnison County over next 20 years, as projected by Colorado Department of Local Affairs.
3. First number - assumes 2% increase as per footnote 2.
4. This second figure assumes 134 additional ADT for coal truck traffic, 30 additional ADT for an increase in 15 people working at Bowie and Oxbow mines, and 100 additional ADT for miscellaneous construction supplies and personnel, government traffic, consultants, sales representatives and the general public visiting the mines. These numbers represent the projected increase over 1996 levels.
5. This second figure assumes an additional 938 ADT over standard 2% increase. This includes an additional 878 ADT for coal truck traffic, 50 additional ADT for an increase in 25 people working at the Bowie and Oxbow mines, and 10 additional ADT for miscellaneous traffic as a result of government personnel visiting the mines, as well as consultants, engineering contractors, sales representatives, and the general public for visits and job searches.

Most of the coal truck traffic utilizes the stretch of State Highway 133 between Paonia and Somerset. Although the overwhelming volume of coal is shipped via rail, there remains the possibility that mines in the North Fork Valley could truck coal to potential customers located on the Western Slope of Colorado or during emergency situations where rail transportation is interrupted. In this situation, coal trucks would utilize State Highway 92 (between Hotchkiss and Delta) and State Highway 50 (north or south of Delta). The likelihood of such coal truck transportation is low, so this EIS analysis focuses on State Highway 133.

3.14.2 Affected Environment

3.14.2.1 Major Transportation Route

The major transportation route servicing the Paonia-Somerset area is State Highway 133. This highway serves local residents and associated commercial traffic for the local communities, including the mining operations in the North Fork Valley. The road also experiences some miscellaneous traffic between the Roaring Fork Valley (Glenwood Springs-Carbondale-Aspen) and the North Fork of the Gunnison River Valley.

State Highway 133 is an asphalt, all-weather, two-lane highway. In Delta County, the road essentially parallels the North Fork of the Gunnison River Valley and has minimal grades. The road intersects State Highway 92 in Hotchkiss, Colorado, bypasses the downtown section of Paonia, passes through the tiny community of Somerset, traverses over McClure Pass at an elevation of 8,755 feet, then essentially parallels the Crystal River, and ultimately intersects with State Highway 82 in Carbondale, Colorado. Portions of this road are designated as a scenic byway.

During the past 20 years, several sections of State Highway 133 have been upgraded and/or relocated. A major section of State Highway 133 between Paonia and Somerset was relocated from the north side of the North Fork of the Gunnison River to the south side of the river. The old State Highway 133 remains in its original location and is used by local residents and employees/commercial traffic for the Bowie No. 1 Mine.

The Colorado Department of Transportation has plans for continuing the upgrade and improvement of State Highway 133. A section of this highway east of the Paonia Reservoir in Gunnison County is presently under construction for realignment and upgrade. The Colorado Department of Transportation has no current plans to upgrade any sections of State Highway 133 in Delta County in the next 5 years.

The state of Colorado is responsible for maintenance of State Highway 133. Periodically during the spring and summer months, sections of State Highway 133 can be closed as a result of mud slides or rock debris. The Colorado Department of Transportation has indicated that there are several sections of this road that have been affected by such activities, primarily in the vicinity of the community of Redstone, the area adjacent to the Paonia Reservoir, and both sides of McClure Pass.

3.14.2.2 Project Access

Both the Bowie and the Oxbow operations are accessed from State Highway 133. The Oxbow operation can be accessed directly from State Highway 133 in the community of Somerset. The surface facilities of this operation are immediately north of the Union Pacific Railroad tracks which transect the town of Somerset. The surface facilities of the Bowie No. 2 operation are accessed from old State Highway 133, approximately 1 mile from a junction between old State Highway 133 and the relocated section of State Highway 133. This junction is approximately 3 miles east of the community of Paonia.

3.14.2.3 Roads on Lease Tracts and Exploration License Areas

There are no all-weather roads on either lease tract or the exploration license area. The areas do have various light-duty roads that have been utilized for past exploration activities, hunting access, and miscellaneous agricultural purposes. The existing light-duty roads located on the lease tracts and exploration license area are narrow, primitive, and generally unsuitable for low clearance vehicles.

The town of Cedaredge is reached by State Highway 65 which intersects State Highway 92 approximately 3 miles east of Delta. State Highway 65 is an asphalt, all-weather, two-lane highway that traverses the Grand Mesa lakes and intersects with Interstate 70 approximately 6 miles east of Palisade. State Highway 65 is generally closed during the winter through the Grand Mesa lakes area.

3.14.2.4 Other Roads in the Region

The community of Paonia is reached by State Highway 187 which intersects State Highway 133 approximately 1 mile north of the downtown area. State Highway 187 is an asphalt, all-weather, two-lane highway, which passes over the North Fork of the Gunnison River on a bridge structure.

The town of Delta is connected with Hotchkiss by State Highway 92, which is also an asphalt, all-weather, two-lane highway. There are numerous asphalt streets within the residential areas of Delta. Fifth Avenue is an east-west street that crosses the North Fork Branch in two locations; to the west of Delta, Fifth Avenue becomes the G-50 county road, which also crosses the North Fork Branch approximately 2 miles west of Delta. The G-50 county road connects with State Highway 50, and is often used as a “shortcut” for local motorists traveling to and from Grand Junction.

State Highway 50 joins Delta with Grand Junction (to the north) and Montrose (to the south). State Highway 50 between Delta and Montrose is an asphalt, all-weather divided four-lane highway. Between Grand Junction and Delta, State Highway 50 remains an asphalt, all-weather two-lane highway; however, there are plans by the Colorado Department of Transportation to upgrade portions of this highway section to a four-lane divided road.

The Bowie No. 1 Mine is accessed from Paonia by the Stephens Gulch Road, which is an asphalt, all-weather, two-lane county road to the entrances of the Bowie No. 1 Mine. The Stephens Gulch Road has been paved with asphalt to the Bowie No. 1 Mine. Beyond the turnoff to the mine, the Stevens Gulch Road is unpaved. The overall condition of the Stephens Gulch Road should be considered as fair, and it requires routine maintenance.

There are numerous secondary roads in Delta County. Most of these county roads are all-weather, but not all of them are paved with asphalt. These roads provide access to rural residences as well as the small Delta County communities. Some of the communities of interest are Austin, Lazear, and Bowie because of their proximity to the North Fork Branch.

3.14.2.5 Union Pacific Railroad - North Fork Branch

The mines in the North Fork of the Gunnison River Valley are accessed by a railroad spur that connects a main Union Pacific line in Grand Junction, Colorado with the mining operations. This spur line is known as the North Fork Branch and is approximately 95.5 miles in length. The railroad passes through the communities of Delta, Hotchkiss, Paonia, and Somerset.

In Delta County, there are approximately 50 public grade crossings and over 100 private grade crossings on the North Fork Branch.

A public grade crossing is a highway-rail crossing where the roadway is under the jurisdiction of and maintained by a public authority. At public crossings, there are two basic types of warnings: passive signs and active warning signs. Their purpose is to attract the driver’s attention and get them to slow down or stop for the crossing and look and listen for a train. It is the driver’s responsibility to be in control of the vehicle and stop as required by the law.

The common crossbuck is the basic passive sign that is typically found at all public crossings. Other passive signs include the red stop signs, yellow yield signs, yellow advance warning signs, and white pavement markings and white stop lines near the crossing.

Active warning signs and devices include flashing lights and gates. Public authorities, such as the Colorado Department of Transportation, determine which crossings warrant active warnings. The type of criteria used to prioritize crossing improvements include vehicle traffic count at the crossing, types of vehicles using the crossing, number of daily trains each way, and the collision history at the crossing.

The BLM and the Forest Service, in cooperation with Delta County, completed an inventory of public crossings between the G-50 county road crossing west of the town of Delta to the end of the North Fork Branch east of the community of Somerset in Gunnison, County. This inventory is on file at the BLM office in Montrose, and at the Delta County offices in Delta. This inventory was conducted to assist communities in making decisions about possible crossing improvements.

Forty-four public rail crossings were inventoried. The inventory information included location, existing warning devices, road standards, surrounding physical information, accident history, and other safety related comments. The intent of the inventory is to provide the community with a tool to assess and prioritize rail crossings for upgrades and improvements.

A private grade crossing is where the road is privately owned and is intended for use by the owner or by the owner's licensees and invitees; it is not intended for public use and is not maintained by a public highway authority. There is no government requirement for private grade crossings to have warning signs; however, any such warning signs or devices would typically be installed by the railroad company at the expense to the private owner. It should be noted that all liability for accidents and injuries which result from the use of private crossings is assumed by the private owner.

In the town of Delta, the railroad crosses State Highway 50 immediately north of where State Highway 50 intersects with State Highway 92. Within the town of Delta, there are numerous grade crossings. Besides Main Street (State Highway 50), the North Fork Branch crosses at Palmer Street, Dodge Street at 1st Street, 2nd Street at Silver Street, 3rd Street at Silver Street, 4th Street at Silver Street, 5th Street at T Street, and 5th Street at Silver Street. There are numerous private crossings into local Delta businesses immediately north of State Highway 92. Except for the Main Street public crossings, all other public crossings in the town of Delta are marked with passive warning signs. On the Main Street public crossing, there are flashing lights and gates. The current speed for the Union Pacific trains through Delta is 25 miles per hour; this speed has increased from the 10 mile per hour limit that was used prior to recent track maintenance and upgrades.

Between Delta and Hotchkiss, the railroad crosses State Highway 92 at a location approximately 5 miles east of Hotchkiss. This crossing is equipped with flashing lights but no gates. The train speed at this location typically ranges from 20 to 25 miles per hour.

The railroad crosses State Highway 92 just west of the town of Hotchkiss, traverses through the middle of Hotchkiss, and crosses State Highway 133 on the east side of the town. The crossings on the west and east side of Hotchkiss on State Highway 92 and State Highway 133, respectfully, are equipped with flashing lights. There are three public crossing within the town of Hotchkiss: Cedar Drive, 2nd Street, and 4th Street; these public crossings have passive warning signs. The train speed through Hotchkiss typically ranges from 20 to 25 miles per hour.

The railroad is located south of State Highway 133 between Hotchkiss and Paonia, but the railroad passes through the community of Paonia with six crossings in this community. The grade crossings in the town of Paonia are Onarga at 1st Street, 2nd Street west of Orchard, North Fork south of 2nd Street, Oak Street south of 3rd Street, 3rd Street east of Oak Street, and

Delta Street south of 4th Street. These grade crossings have passive warning signs. The train speed through Paonia typically ranges from 15 to 20 miles per hour.

The railroad spur terminates near the West Elk Mine, which is located east of Somerset. There are loadout facilities along the North Fork Branch for the West Elk Mine, the Oxbow Sanborn Mine, the Terror Creek Coal Loadout, and the Bowie No. 1 Loadout. See *Figure 31, Rail and Road System.*

In 1998, the Union Pacific Railroad indicated that 850 trains utilized the North Fork Branch. This translates to an average of 2.5 trains per day. In actuality during 1998, there were many days in which no trains traveled the route, and other days when six trains made trips on the North Fork Branch. The amount of traffic on the rail system was dictated by the demand of the coal operations and the availability of railroad cars (Connor, 1999, personal communication).

The Union Pacific railroad estimated that 8.6 million tons of coal were shipped in 1998. This is up from the 6.8 million tons shipped by rail in 1995 but less than the 10.3 million tons of coal projected to be shipped in 1999. See *Table 3.14-2, Coal Production From North Fork Valley Coal Mines.*

Table 3.14-2
Coal Production From North Fork Valley Coal Mines[1]

	1995 (Actual)	1998 (Actual)	1999 (Projected)	2000 (Projected)	2005 (Projected)
Bowie No. 1 Mine (Bowie Resources)	0.5	---	---	---	---
Bowie No. 2 Mine (Bowie Resources)	---	1.2	1.8	5.0	5.0
Sanborn & Elk Creek Mines (Oxbow Mining)	1.1	1.5	1.5	4.0	6.0
West Elk Mine (Mountain Coal)	5.2	5.9	7.0	7.3	8.2
TOTAL	**6.8**	**8.6**	**10.3**	**16.3**	**19.2**

1. Source: North Fork Coal Working Group

The Union Pacific Railroad is responsible for maintenance of the North Fork Branch. The railroad has made a commitment to an improved railroad system, and such maintenance work was underway in 1999 with replacement of track and ballast for many sections of the line.

3.14.3 Environmental Consequences

There is a possibility under certain circumstances that coal could be trucked to market. See Section 3.14.1, Introduction. The likelihood of such coal truck transportation is low and would be of short duration. Any additional effects would be minimal. Consequently, this analysis focuses on State Highway 133.

Effects to State Highway 133 would result from an increase in daily coal truck traffic between the Bowie No. 2 Mine and the Bowie No. 1 Loadout. Effects to the North Fork Branch of the Union Pacific Railroad would result from increased rail traffic on the North Fork Branch to and from the Bowie No. 1 Loadout, the Oxbow Loadout, and the West Elk Mine Loadout. The

magnitude and duration of effects associated with traffic related activities would depend on the amount of coal produced and sold from the mines.

If coal production at the Bowie No. 2 Mine is increased from 1.2 million tons in 1998 to a projected 5 million tons in 2000, ADT on State Highway 133 between the Bowie No. 2 Mine and the Bowie No. 1 Loadout would increase from 234 to 978, a 400 percent increase. In 1998, the coal truck traffic from the Bowie No. 2 Mine represented an estimated 7 percent of the traffic on State Highway 133 between the mine and the loadout. If production is increased to 5 million tons a year in the year 2000 and beyond, the coal truck traffic would represent approximately 21 or 22 percent of the total traffic on that stretch of State Highway 133 between the mine and the loadout. It is assumed that coal traffic between the Bowie No. 2 Mine and the Bowie No. 1 Loadout would occur on a 24-hour basis. Other than coal truck traffic, other mine related traffic would involve only very minor increases to the ADT levels on State Highway 133 between Paonia and Somerset.

Projections call for coal production to increase from the North Fork Valley coal mines from 1998 to 2005. This production increase would relate to increased train traffic on the North Fork Branch. In 1998, with 8.6 million tons of coal shipped on the Union Pacific Railroad from the North Fork mines, there were an average of 4.4 trains per day (loaded and empty) traveling on the North Fork Branch. If production increases to 19.2 million tons in 2005, there would be an average of 10 trains per day (loaded and empty) on the same rail line. In 1998, it is estimated the average interval between trains was 5 hours and 27 minutes. If coal production increases to 19.2 million tons in the year 2005, the average interval between trains would be more than cut in half to 2 hours and 24 seconds.

ADT is defined as the measure of traffic over a 24-hour period and is determined by counting the number of vehicles (or trains) passing a specific point from both directions on a given road or rail line. In assessing ADT levels for train and vehicular traffic in this North Fork Coal EIS, it is assumed that all traffic would return on the same day that was used for initial access; therefore, one vehicle going to and from (round trip) one of the mines in the area would result in an ADT of two. Similarly, it is assumed that a unit train traveling to a mine loadout would make one round trip per day, thus resulting in an ADT of two.

3.14.3.1 Effects of Alternative A (No-Action)

If the exploration license is denied and the coal lease tracts are not issued, mining operations in the North Fork Valley would continue. Production rates could reach the levels set forth in *Table 3.14-2, Coal Production From North Fork Valley Coal Mines*; however, the mining operations would probably be of shorter duration. See Section 3.14.3.2, Direct Effects Common to All Alternatives.

3.14.3.2 Direct Effects Common to All Action Alternatives

Effects to State Highway 133 - Iron Point Exploration License Area - Increases in traffic on State Highway 133 as a result of exploration activities in the Iron Point Exploration License area would be very minor and not noticeable. Such traffic would involve the daily use by geologists and drillers accessing the site. Such use is expected to add less than ten ADT levels to State Highway 133, which would represent less than ~~one-half of one~~ ½ percent increase to any traffic loads.

Effects to State Highway 133 - Iron Point Coal Lease Tract - For purposes of this analysis, it is assumed that coal production from the Iron Point Coal Lease Tract would be mined from the existing Bowie No. 2 Mine portal area and hauled to the Bowie No. 1 Loadout using 28-ton

trucks and portions of old State Highway 133 and new State Highway 133 between the mine and the loadout. *Table 3.14-2, Coal Production From North Fork Valley Coal Mines*, illustrates that coal production from the Bowie No. 2 Mine is projected to increase from 1.2 million tons in 1998 to 5 million tons in 2000. As a result, coal truck traffic would increase on State Highway 133 between the mine and the loadout as presented in *Table 3.14-1, Annual Average Daily Traffic - State Highways 92 and 133.* Using 28-ton capacity highway coal trucks, incremental shipments of 500,000 tons of coal would require 98 ADT. Thus, the coal truck ADT can be calculated for 28-ton capacity trucks as shown on *Table 3.14-3, Coal Truck Traffic for 28-Ton and 45-Ton Truck Capacities,* and is graphically illustrated on *Figure 32, Coal Truck Traffic vs Coal Tonnage Shipped.* The amount of coal trucked from the Bowie No. 2 Mine to the Bowie No. 1 Loadout would be dependent on coal sales.

If coal production increases at the Bowie No. 2 Mine as indicated on *Table 3.14-2, Coal Production From the North Fork Valley Coal Mines*, average daily truck traffic would increase from 234 ADT in 1998 to 978 ADT in 2000. The 234 coal truck ADT in 1998 represents an estimated 7 percent of all vehicular ADT on State Highway 133 between the mine and the loadout. This figure would rise to 22 percent in the year 2000, when 978 coal truck ADT would be needed to ship the projected 5 million tons of coal.

Table 3.14.3
Coal Truck Traffic for 28-Ton and 45-Ton Truck Capacities[1]

Annual Coal Transported By Truck[2] (tons)	ADT[3] (28 tons/truck)	ADT[3] (45 tons/truck)
500,000	98	61
1,000,000	196	122
2,000,000	391	244
3,000,000	587	365
4,000,000	783	487
5,000,000	978	608

Notes:
1. For a geographic representation of this table, see Figure 32, Coal Truck Traffic vs. Coal Tonnage Shipped.
2. This represents a range of coal tonnages that could be shipped from the Bowie no. 2 Mine via coal truck to the Bowie No. 1. Mine.
3. ADT is average daily traffic. For this table, the ADT values represent the number of times a coal truck would pass a fixed location on the highway. For example, at 98 ADT, this would relate to 49 round trips (49 trips loaded with coal going from the mine to the train loadout and 49 trips returning empty from the train loadout to the mine).

In 1998, the ADT for State Highway 133 between the Bowie No. 2 Mine and the Bowie No. 1 Loadout was estimated at 3,541. This translates to an average hourly traffic of 148 vehicles, or 2.5 vehicles passing a fixed point along the road per minute. Of this traffic, there would be an average of 9.75 coal trucks per hour or an average of 0.16 coal trucks per minute. This translates to a coal truck passing a fixed point (either loaded with coal or empty) on State Highway 133 every 6.25 minutes.

For 2000, it is estimated that the ADT for State Highway 133 between the Bowie No. 2 Mine and the Bowie No. 1 Loadout would be 4,348 vehicles. This would mean 181 vehicles passing a fixed location along this highway every hour, or an average of three vehicles per minute. If production from the Bowie No. 2 Mine reaches 5 million tons in the year 2000, ADT for coal trucks would be 978. This translates to 40.75 coal trucks per hour or 0.68 coal trucks per minute. Under this scenario, the interval between coal trucks along State Highway 133

between the mine and the loadout would be less than 2 minutes; this estimate was verified by a spot field observation in January 2000.

There would also be some addition to employee and supply traffic as a result of increases in coal production from the Bowie No. 2 Mine; however, this additional traffic should be minimal given only minor increases expected to employment.

Development and extraction of the coal from the Iron Point Coal Lease Tract is not expected to cause exceedances of the design standard for traffic volume on State Highway 133, even with increased coal truck traffic from the Bowie No. 2 Mine to the Bowie No. 1 Loadout. However, increased coal truck traffic would probably mean additional maintenance work.

Effects to State Highway 133 - Elk Creek Coal Lease Tract - For purposes of this analysis, it is assumed that coal would be mined from the Elk Creek Coal Lease Tract at levels shown on *Table 3-14.2, Coal Production From North Fork Valley Coal Mine*. As a result, employee and supply traffic associated with this mining would be similar to that already existing on State Highway 133 between Paonia and Somerset.

Presently, Oxbow is shipping approximately 150,000 tons of coal per year to the Terror Creek Loadout. Oxbow owns and operates its own 28-ton capacity trucks. Assuming that coal is hauled to the Terror Creek Loadout for 250 days a year on an 8-hour shift, the ADT for this traffic would be 42 from Monday through Friday. There are no plans to increase this capacity, so coal truck traffic from the Oxbow facilities to the Terror Creek Loadout would probably remain the same, even in the event that the Elk Creek Coal Lease Tract is developed.

Development and extraction of the coal from the Elk Creek Coal Lease Tract would not cause exceedances of the design standard for volume of traffic on State Highway 133.

Effects on North Fork Branch of Union Pacific Railroad - It is assumed for this analysis that ~~all~~ coal tonnage mined from either the Iron Point or the Elk Creek Coal Lease tracts would be shipped to market via the Union Pacific Railroad on the North Fork Branch except for some coal trucked to the Terror Creek Loadout or down-valley to some other local user. There is a possibility under certain circumstances that coal could be trucked to market. See Section 3.14.1, Introduction.

In 1998, a total of 8.6 million tons of coal were shipped on the Union Pacific Railroad from North Fork Coal mines. This amounts to 1.2 million tons from the Bowie No. 2 Mine, 1.5 million tons from the Sanborn Creek Mine, and 5.9 million tons of coal from the West Elk Mine. A small amount of coal (150,000 tons) was shipped on the Union Pacific from the Terror Creek Loadout.

Once in development, 5 million tons of coal would be produced from the Iron Point Coal Lease Tract, and a range of 4 to 6 million tons of coal would be produced from the Elk Creek Coal Lease Tract.

Public Safety - There are an infinite number of accident scenarios that could be developed for the highway traffic and railroad transportation for projects in the North Fork Valley. Analysis of such scenarios would include varying levels of complexity and portray a variety of results. It is often difficult to talk about accidents in that we do not wish to be alarmists, but we do want to convey a reasonable assessment of the potential for accidents and the potential for impacts to public safety.

For example, an accident assessment of a trip in an automobile or an airplane can be very frightening. We know that, but we prefer not to think about it, and we continue to take those trips anyway. However, the knowledge of a certain type of accident may persuade us to take extra precautions enroute.

With the potential increase in daily traffic, particularly the increase in coal truck traffic from the Bowie No. 2 Mine to the Bowie No. 1 Loadout, it is reasonable to assume that accidents could increase over the life of any mining activities.

With the continuation and potential for increasing coal production from the North Fork Valley mines, there would be an increase in train traffic on the North Fork Branch of the railroad. See *Table 3.14-4, Unit Train Traffic Frequency on North Fork Branch*, and *Figure 33, Average Daily Coal Train Traffic for North Fork Branch.* With the potential increase in daily coal train traffic, it is reasonable to assume that accidents could increase with increased train shipments. Certainly, with the increased train traffic, the potential for highway vehicles and train accidents at rail crossings would increase, as the interval frequency between trains entering and leaving the valley would increase with increased coal production. This is true for both public and private crossings.

Table 3.14-4
Unit Train Traffic Frequency on North Fork Branch

Year	Coal Shipped (tons x 000,000)	Average number of Trains Per Day (loaded & empty)	Average Interval Between Trains
1995	6.8	3.6	6 hr 40 min
1998	8.6	4.4	5 hr 27 sec
1999	10.3	5.4	4 hr 26 sec
2000	16.3	8.6	2 hr 47 sec
2005	19.2	10.0	2 hr 24 sec

Likewise, with the number of increased coal trains frequenting the North Fork Branch, there is a potential for derailments. Although rare, train derailments have occurred in populated areas, causing property damage and even fatalities. Train derailments can also cause brush fires in areas along trackage, which could endanger property and personal safety.

However, similar to increases in highway traffic, the increase in railroad accidents may not be directly proportional to the increase in coal train traffic because of mitigation measures which might include lower speeds in populated areas, newly installed warning signals or lights at train crossings, better gates at train crossings, the elimination of crossings, upgrade of the railroad line, and general public awareness of increased train traffic.

As part of the public railroad grade crossing inventory conducted, categories of the possible crossing upgrades were developed. In addition, planning cost estimates were provided. See Section 3.14.5, Potential Transportation Mitigation and Monitoring, for some of the costing estimates. Rough cost estimates to upgrade the preliminary identified high priority, public crossings range from $8 to $16 million.

Delays at train crossings can also have an impact on public safety. Ambulance service, as well as police and fire response times could be delayed five to seven minutes when crossings are

blocked. *Table 3.14-5, Vehicles Delayed at Grade Crossings*, illustrates the average number of vehicles that could be delayed to correspond with varying ADT levels.

Table 3.14-5
Vehicles Delayed at Grade Crossings

Average Daily Traffic (ADT)	Average Traffic Per Minute	Average Number of Vehicles Delayed at Crossing	
		5 minutes	7 minutes
500	0.35	2	3
1,000	0.69	3	5
2,000	1.39	7	10
3,000	2.08	10	15
4,000	2.78	14	19
5,000	3.47	17	24
6,000	4.17	21	29
7,000	4.86	24	34
8,000	5.56	28	39
9,000	6.25	31	44
10,000	6.94	35	49
11,000	7.64	38	53
12,000	8.33	42	58
13,000	9.03	45	63
14,000	9.72	49	68
15,000	10.42	52	73
20,000	13.88	70	97

To date, little direct impact to these services has been experienced, although few cases of trains causing serious delays to emergency medical services have been documented. When and where possible, emergency vehicles can detour to access unblocked crossings and go around the trains. There has been a report from the local fire department that over the past 7 years a house burned down in Paonia as fire trucks waited for a train to pass. With increased railroad traffic, there is an increased potential that emergency vehicles could be delayed in the future.

There is another aspect of trains and the public. Although not labeled as a public safety problem, the increased train traffic on the North Fork Branch may also lead to increased public frustration as people are stopped more frequently for passing trains. Although this is not necessarily a public safety concern, it could become one, if frustrated motorists try to "beat" the train to a crossing. This scenario actually happened in the spring of 1999 in the state of Illinois when a semi truck went around gates at a railroad crossing and was involved in an accident with Amtrak, resulting in fatalities. As noted from several scoping comments received on the project, certain individuals expressed anxieties about increased train traffic and increased delays at road/train crossing areas. One commentor suggested that senior citizens at the

senior nursing facility in Hotchkiss north of the track felt anxiety that they may not get necessary medical treatment in the case of an emergency vehicle being delayed as a train passes through Hotchkiss blocking access. Under unique conditions, it is possible that a unit coal train could block both Highway 92 and Highway 133 grade crossings on either side of Hotchkiss, as well as the three crossings in town.

There was also concern about increased frustration when train traffic blocks rush hours on the highways. For example, businesses in Delta note delays for customers and suppliers. The result is a potential loss to their businesses as trains pass through Delta, blocking State Highway 50 (Main Street) and Palmer Street. Delays can back up many vehicles at the grade crossings. See *Table 3.14-5, Vehicles Delayed at Grade Crossings*. To respond to concerns about vehicular delays with the town of Delta, the Union Pacific has upgraded track within Delta and increased train speeds from 10 miles per hour to 25 miles per hour. The increased speed helps to reduce delay time for motorists. Other businesses note the potential loss in worker productivity if employees are delayed in accessing other work sites.

Presently, the train engineer can not talk to local citizens or local emergency service, fire, or police officials. In order to contact the train engineer, local officials must communicate with the train dispatcher in Grand Junction. Public safety may be jeopardized in the time needed for communicating from emergency service providers to the dispatcher back to the train engineer. When "time is of the essence," such as stopping a train before it reaches a crossing or uncoupling a train to allow for some emergency response, improved communication with local emergency departments and the train engineer would be beneficial.

Environmental Safety - Most supplies and materials needed for the mining operations would be purchased from vendors outside Delta and Gunnison counties. Fortunately, coal mines do not require hazardous chemical materials for their operations; however, diesel fuel, limestone (rock dust), minor amounts of explosives, and maintenance supplies such as grease cleaners, antifreeze, etc. are transported to the sites. These materials would be transported in conformance with U.S. Department of Transportation regulations. Accident prevention would be the principal objective during transportation of any supplies to the site.

Impacts to soils, surface water and groundwater resources, and wildlife could result from accidental spills or train derailments. In the event of an accident, contingency planning would prove beneficial. Any spills or derailments would be cleaned up and the contaminated soils disposed of or rehabilitated as specified in Spill Prevention Control and Countermeasure (SPCC) plans.

Long-Term Maintenance - Under all alternatives, portions of State Highway 133 and the North Fork Branch would experience increased traffic. Such traffic could increase the need for maintenance during operations. The state of Colorado budgets $110 million per year for state-wide maintenance. Region 3 of the Colorado Department of Transportation, which would maintain State Highway 133, has a budget of $20 million per year for maintenance. This maintenance budget must handle approximately 2,000 miles of roads in Region 3. At present, there are no revenues in the current five year plan of the Colorado Department of Transportation for improvements to State Highway 133 between Paonia and Somerset; however, funds are available for ongoing maintenance.

The Union Pacific Railroad has made a commitment to rail service to the North Fork mines, and this commitment would translate to increased maintenance on the North Fork Branch (Paul Connor, 1999, personal communication)

3.14.3.3 Indirect Effects Common to All Alternatives

Indirect effects to the transportation network, specifically in Delta County, might result from additional non-work related trips made by new persons (workers and their families) that would move into the region as a result of the coal mining operations. This might include new workers hired at the mines, workers hired to be employed in the service industry in the region, or simply people looking for potential jobs associated with the mining activities. The increase in traffic, however, would probably be dispersed throughout Delta County and would not be concentrated on State Highway 133 between Paonia and Somerset. Therefore, this traffic would only be a minor component in the cumulative impacts on any roads near the proposed mine sites.

3.14.3.4 Cumulative Effects Common to All Alternatives

Projected traffic associated with mining the Iron Point and Elk Creek Coal Lease tracts would be combined with other traffic in the area on State Highway 133. Such traffic would come from continued mining at the West Elk Mine, future exploration activities, recreational users, logging and residential traffic. All of this traffic would result in some cumulative effects. As shown on *Table 3.14-1, Annual Average Daily Traffic - State Highway 92 and 133*, it is assumed that there would be a 2 percent increase per year on the local highway systems in Delta County, approximately equal to the average growth rate projected for Delta County over the next 20 years. The traffic resulting from adjacent and surrounding activities would increase the traffic volume on State Highway 133 and would add to the possibility of accidents.

The effect of increasing production on the Elk Creek Coal Lease Tract to 6 million tons per year would be increased transportation from the North Fork Valley, primarily from railroad shipments of coal.

3.14.3.5 Effects of Alternative B, C, and D

Same as discussed in Section 3.14.3.2, Direct Effects Common to All Alternatives. The only differences anticipated between these three alternatives might be the duration of mining. For example, if multiple seam mining is allowed under Alternative C, the duration of mining would be greater than Alternative B. Similarly, the mining under Alternative D would be greater than Alternative B, but may be less than Alternative C as certain areas are protected from subsidence, thus minimizing the amount of coal mined in certain selected areas.

3.14.4 Other Transportation Options

As discussed in Section 2.7, Transportation Options, scoping commentors requested that options be discussed to two main issues:

- Coal truck traffic from the Bowie No. 2 Mine to the Bowie No. 1 Loadout; and
- The ability of the Union Pacific Railroad to handle increased coal tonnage from the mines in the North Fork Valley.

In response to these issues, the effects of certain options are discussed below.

3.14.4.1 Increase Capacity of Highway Coal Trucks

At present, both Bowie and Oxbow are using highway coal trucks with the capacity to haul 28 tons of coal. There has been some discussion about the potential of increasing that capacity to

45-ton highway trucks. Such an increase would require approval of the Colorado Department of Transportation, if such larger capacity trucks are to use State Highway 133.

If possible to increase tonnage from 28 to 45 tons per truck, the ADT for coal haulage would be less. See *Table 3.14.3, Coal Truck Traffic for 28 Ton and 45 Ton Truck Capacities.* For a graphical representation, see *Figure 32, Coal Truck Traffic vs Coal Tonnage Shipped.* For example, at a coal production level of 5 million tons per year there would be 978 ADT for 28-ton trucks as compared 608 ADT for 45-ton trucks. This would result in a reduction of 370 ADT, or approximately a 38 percent reduction in coal truck traffic over the use of 28-ton trucks. However, the use of 45-ton trucks would still represent an increase in traffic on State Highway 133 between the Bowie No. 2 Mine and the Bowie No. 1 Loadout from an estimated ADT of 234 coal trucks (28-ton capacity) in 1998 to 606 ADT for 45-ton capacity trucks at the 5 million ton per year level. This represents an approximate 250 percent increase in coal truck traffic over 1998 levels.

3.14.4.2 New Rail Loadout Adjacent to Bowie No. 2 Mine

One way to eliminate coal truck traffic from the Bowie No. 2 Mine to the Bowie No. 1 Loadout would be the construction of a new rail loadout adjacent to the Bowie No. 2 Mine that would replace the Bowie No. 1 Loadout. This action would reduce coal truck traffic. At a production level of 5 million tons per year using 28-ton trucks 978 ADT would be eliminated. Similarly, at lesser production rates, the ADT for coal truck traffic would be reduced. See *Figure 32, Coal Truck Traffic vs. Coal Tonnage Shipped.*

Elimination of coal truck traffic from the Bowie No. 2 Mine to the Bowie No. 1 Loadout has the potential to decrease highway traffic by approximately 21 to 22 percent at a production rate of 5 million tons per year. However, this increased coal truck traffic (at the 5 million ton per year rate) would not affect the operation and design limits of State Highway 133. Similarly, reduction of traffic would decrease to the potential for less accidents, but to what specific amount is difficult to actually quantify.

Construction of a new railroad loadout at the Bowie No. 2 Mine would not be without its own effects. There would be disturbances associated with the construction of a new rail loadout facility. An additional 15 to 25 acres of surface would be disturbed for such facilities. Topsoil would be removed prior to construction, and the area would be removed from its current use for agricultural, wildlife, or residential use. With the construction of such a facility, there would be an increased potential for erosion and sedimentation, thus having a potential to impact water quality and fisheries. Such facilities could also have aesthetics (light and glare) and noise impacts. There could also be effects to the ingress/egress of residents and noise impacts in the immediate vicinity of the new loadout.

3.14.4.3 Separate Haul Road

To eliminate coal truck traffic from the Bowie No. 2 Mine to the Bowie No. 1 Loadout, it was suggested that a separate, stand-alone haul road be constructed, and off-highway coal trucks be utilized. Similar to the discussion in Section 3.14.4.4, New Railroad Loadout Adjacent to Bowie No. 2 Mine, this option would eliminate highway coal truck transportation on approximately 3 miles of State Highway 133; however, this option is not without impacts of its own.

The construction of a stand-alone haul road for 3 miles would probably disturb 50 to 150 acres, depending on its location and the amount of "cut and fill." Similarly, there would be increased noise and air pollution from coal haulage. There would be the need to acquire the right-of-way

and build the road, which could cause increased sedimentation and impacts to wetland/riparian areas. The area in the North Fork of the Gunnison River Valley is constricted, and any construction of a separate stand-alone haul road might require substantial cuts and fills. There would also probably be the need to have an overpass or underpass on State Highway 133 to prevent the large off-highway coal haulers from interfering with normal traffic on State Highway 133.

3.14.4.4 Conveyor

This option would be similar to a separate haul road as discussed in Section 3.14.4.5, Separate Haul Road. Constructing a conveyor from the Bowie No. 2 Mine to the Bowie No. 1 Loadout would have similar constraints, although a conveyor right-of-way would be much narrower than a haul road corridor. Construction of a conveyor over a 3 mile distance in this area would probably impact 10 to 20 acres.

3.14.4.5 Capacity of North Fork Branch

The amount of coal train traffic on the North Fork Branch would depend on the following items:

- The physical limitations of the rail line, including the condition of the track, track structure such as grades and curvature, train speed, and the number of sidings;

- The availability of railroad cars; and,

- The demand for coal from the mines in the North Fork Valley.

As explained in Section 1.9.8, Railroad Maintenance/Improvements, the Union Pacific is undertaking a schedule of maintenance and upgrades on the North Fork Branch. The purpose of this maintenance is to allow train speeds to be increased, which would increase the amount of coal that can be moved on the line. Typically, speeds on the North Fork Branch range from 10 to 30 miles per hour. The maintenance currently being completed would allow speeds greater than 10 miles per hour, but maximum speeds would probably remain under 30 miles per hour.

As an example, recent maintenance work on the track in the town of Delta now allows trains to move at approximately 25 miles per hour through Delta, as compared to 10 miles per hour prior to the maintenance work. This increased speed means less delays at grade crossings but would increase train noise and could surprise motorists accustomed to slower train speeds and result in more accidents.

On one-way spur lines such as the North Fork Branch, one of the chief controlling limits to coal shipments is the number of sidings. Obviously, scheduling becomes critical as the amount of coal shipments increase. Further, it is important to the economics of the Union Pacific that trains are not delayed for undue time periods on the sidings or waiting to access the spur line itself .

As explained in Section 1.9.8, Railroad Maintenance/Improvements, there are presently two coal train sidings on the North Fork Branch. One is near Roubideau (between Grand Junction and Delta) and the other on Rogers Mesa near Lazear (between Delta and Hotchkiss).

With concise scheduling, the improvements made to the line, and increased train speed, the Union Pacific could probably handle the projected 2005 tonnages from the mines in the North

Fork Valley as set forth in Table 3.14-2, Coal Production From North Fork Valley Coal Mines (Paul Connor, Union Pacific Railroad, 1999 personal communication).

However, the Union Pacific also recognizes the need for flexibility and contingencies in managing coal shipments from the North Fork coal mines, so the firm is considering the installation of two new sidings (one at Whitewater and the other at Payne), as well as the use of the "Y" side track at Converse (the Bowie No. 1 Loadout), if and when a new train loadout is constructed adjacent to the Bowie No. 2 Mine. With these additions, the Union Pacific could handle the projected 2005 tonnages (Robert Gutierez, Union Pacific Railroad, 2000 personal communication).

3.14.5 Potential Transportation Mitigation and Monitoring

The potential mitigation measures for transportation are set forth in *Table 3.14-6, Potential Mitigation Measures for Transportation.*

Table 3.14-6
Potential Mitigation and Monitoring Measures for Transportation

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
T-1	Reduce the potential for accidents on State Highway 133 between Paonia and West Elk Mine	Place increased warning signage on State Highway 133	2-3	Colorado DOT
T-2A	Reduce the potential for coal truck accidents between the Bowie No. 2 Mine and the Bowie No. 1 Loadout on State Highway 133	Use 45 ton capacity trucks	3	Colorado DOT Mining Company
T-2B[3]	Reduce the potential for coal truck accidents between the Bowie No. 2 Mine and the Bowie No. 1 Loadout on State Highway 133	New loadout, private haul road or conveyor	1	Colorado DMG Mining Company Colorado DOT
T-2C	Reduce the potential for coal truck accidents between the Bowie No. 2 Mine and the Bowie No. 1 Loadout on State Highway 133	1. Post "lower" speed limit signs 2. Voluntarily reduce speed of coal trucks	3	Colorado DOT Mining Company
T-3	Reduce the potential for vehicle - coal truck accidents at the entrance to the Bowie No. 1 Loadout on State Highway 133	Improve ingress/egress to Bowie No. 1 Loadout; this would include longer acceleration/deceleration lanes, increased signage, and reduced speed limits	2	Colorado DOT Mining Company
T-4	Reduce the potential for accidents at road-railroad grade crossings	Upgrade warning signs and/or devices	2	Colorado DOT Delta County City of Delta
T-5	Reduce potential for accidents and noise at road-rail grade crossings	1. Close certain crossings 2. Construct grade separations (overpasses or underpasses 3. Re-route train trackage	1	Colorado DOT Delta County City of Delta Union Pacific
T-6	Reduce potential for accidents, delays and noise within the town of Delta	Re-route North Fork Branch north of 2nd Street and south of Confluence Park	2	Union Pacific City of Delta

Table 3.14-6
Potential Mitigation and Monitoring Measures for Transportation

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
T-7	Improve emergency service response time in the event of road-rail crossing delay	Locate emergency equipment, personnel and supplies on both sides of track	2	Emergency Service Providers through funding from local government and/or mining companies
T-8	Improve emergency response capability and service in the event of road-rail crossing delay	Provide better communication between Union Pacific and local emergency service providers	2	Union Pacific Local Government Entities
T-9	Reduce potential for accidents at road-rail grade crossings	Increase awareness through public education	3	Union Pacific Mining Company Local Government Officials
T-10[3]	Repair damaged paved portions of Steven's Gulch Road, which were damaged by historic coal hauling activity	Perform maintenance and repair work	1	NFCWG
T-11[3]	Reduce impacts from increased rail traffic	Establish a 5 million ton of coal per year cap for Bowie	3	NFCWG
T-12[3]	Improve public safety at the intersection of old and new Highway 133	Upgrade, as necessary, to CDOT standards	2-3	NFCWG
T-13[3]	Promote improved public health and safety at railroad crossings	Provide funds to a NFCWG rail transportation fund	1-2	NFCWG

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

T-1 - Place increased signage on State Highway 133 between Paonia and the West Elk Mine. This signage would be effective in warning motorists that heavy truck traffic is possible over this stretch of highway.

T-2 - The use of 45 ton capacity trucks would decrease the volume of coal truck traffic on State highway 133. Moving the rail loadout, building a private haul road, or installing a conveyor would significantly reduce the coal truck traffic on State Highway 133. Posting reduced speed signs for the stretch of State Highway 133 between the Bowie No. 2 Mine and the Bowie No. 1 Loadout would be somewhat effective. This would also be effective in lowering noise levels.

T-3 - Improve the ingress and egress areas of the Bowie No. 1 Loadout on to State Highway 133 to provide for better visibility and/or easier merging of coal truck traffic with existing traffic.

T-4 - To provide for increased warning at highway-railroad grade crossings, the existing warning signs and devices could be improved or upgraded. For example, stop signs could be added to supplement the common crossbuck. Pre-warning signs could be placed where none exist. A cost estimate for improved passive signage installation (crossbucks, advance railroad

warning signs, yield or stop signs, and pavement markings) could approach $10,000 per grade crossing. Active devices could be added which would include flashing lights and gates; these active devices cost approximately $100,000 for each crossing. Where only flashing warning lights are found, gates could be added.

T-5 - One way to reduce the potential for accidents at railroad crossings with roads is to eliminate the potential for train-vehicle interaction. The potential of closing certain crossings, specifically in Paonia, would be effective and could be evaluated. The communities could target priorities for highway/railroad crossings. With such priorities, the appropriate officials and groups could work to obtain federal or state funds to improve the signage or lighting at railroad crossings.

T-6 - There are numerous public grade crossings within the town of Delta. One option to reduce the number of these crossings would be to reconstruct and re-route a portion of the existing rail line in Sections 13 and 14, T15S, R96W, to bypass 2nd through 5th Street crossings. This new line would be located north of 2nd Street and south of Confluence Park. This relocation would also eliminate the "U" shaped track curvature on the west side of Delta, which might allow the Union Pacific to further increase train speed to reduce delays to motorists at crossings.

Certain crossings might be targeted for grade separation, that is the construction of an overpass (or underpass), which would be effective in separating the railroad from the highway. Construction costs could range from $5-20,000 for such an undertaking.

Another option would be the re-routing of train traffic around populated areas, such as the communities of Paonia, Hotchkiss, and Delta. This would eliminate rail traffic within the towns. Estimated costs for this option could involve $1-5,000,000 per mile of new construction, as well as certain environmental consequences (disturbances to wetlands and/or wildlife habitats, erosion and sedimentation potential, aesthetics, etc.).

T-7 - Although most emergency service providers understand and have considered the need for providing emergency services on each side of the tracks, with increased coal shipments on the railroad, this need should be re-examined. In some cases, the emergency service providers may need additional emergency equipment and personnel on either side of the tracks, available to respond in an emergency situation.

T-8 - Improved communication capabilities between the Union Pacific Railroad and local emergency service providers would be beneficial. In emergency situations, rapid communication is always essential in minimizing or preventing property damage and fatalities.

T-9 - Awareness can lead to less accidents. Government officials, the Union Pacific Railroad, the mining companies, and concerned citizen groups should continue their efforts to educate employees, the general public, and visitors to the area about highway safety and accident prevention. Increased awareness can be effective and result in lower accident rates. One way to increase awareness would be to take greater advantage of the services of Operation Lifesaver. This group is a non-profit, nationwide public education program dedicated to reducing crashes, injuries and fatalities at intersections where roadways meet railways and along railroad rights-of-way. Operation Lifesaver has a representative in Grand Junction to service western Colorado.

3.15 SOCIOECONOMICS

Issue: *Address the social and economic impacts on local residents of Delta and Gunnison counties. Areas of concern include: impacts to nearby communities as the result of mine closures or continuation of mining and such impacts on housing, utilities, employment, public services, community services, and present lifestyles; the effect of mine closure on workers and their families; the influx of new workers if production rates increase; and, the effects of temporary and permanent mine shut down.*

3.15.1 Introduction

This section provides an overview of the socioeconomic aspects of the existing conditions of the area, as well as the impacts associated with pending decisions on the proposed coal exploration license and lease applications. The discussion in this section differs from previous sections. The analysis will compare the potential impacts for all alternatives, including the No-Action Alternative, to the existing conditions. It was felt that portrayal of information in this fashion would be more informative to the reader and the decision-makers.

For purposes of the socioeconomic assessment, primary, secondary, and tertiary study areas are defined as follows:

- The primary study area is the geographic area that is anticipated to be most directly affected by the potential project. This is defined to include all communities within Delta County.
- The secondary study area is the geographic area expected to be indirectly affected by the potential project. This area covers all of Delta and Gunnison counties.
- The tertiary study area covers an even larger geographic area that is expected to experience broader cumulative social effects and provide a context for other non-mine related changes occurring in the primary and secondary study areas. For this analysis, the tertiary study area is defined to include the seven-county central western slope area of Delta, Gunnison, Mesa, Montrose, Ouray, Pitkin, and San Miguel.

In response to comments on the Draft EIS, a supplemental economic impact assessment was conducted to incorporate Local Economic Information and Forecasting Assistance (LEIFA) data into the IMPLAN economic impact model. See Section 3.15.3, Environmental Consequences, for further discussion. Additional details regarding the socioeconomics of the area are set forth in *Appendix L, Socioeconomic Report.*

3.15.2 Existing Conditions

The discussion of existing conditions provides a review of existing conditions in area communities. This baseline assessment is then used to measure potential economic and fiscal impacts associated with each project alternatives.

3.15.2.1 Population

As of 1998, approximately 26,600 residents live in Delta County, the primary study area. Population has increased by 3 percent annually since 1990. This rate of growth is faster than the rate of growth occurring in the broader secondary and tertiary study areas as well as statewide.

The City of Delta is the largest incorporated community in the primary study area with 5,600 residents residing within the city limits; this amounts to 21 percent of all residents living in the primary study area. After Delta, the next largest cities are Orchard City, Cedaredge, Paonia, Hotchkiss and Crawford, respectively. Together, the incorporated communities within the primary study area account for nearly 50 percent of total Delta County population.

The two-county secondary study area has a combined population of 39,075 as of 1998. Secondary study area population has increased at an average rate of 2.8 percent annually since 1990, with the greatest increase occurring between 1993 to1995.

At any given time, an estimated range of 88 to 96 percent of Bowie, Oxbow (Sanborn) and West Elk mine employees live in Delta County. A range of 56 to 67 percent of mine employees typically live in the Paonia/Hotchkiss area.

The Colorado Department of Local Affairs forecasts that Delta County's population can be expected to increase by another 16,000 residents over the next 20+ years. This equates to an average growth rate of 2.2 percent annually, a rate of growth below what has occurred over the last 8 years. Population in the secondary study area is forecast to grow at a similar rate annually (2.1 percent).

3.15.2.2 Housing

Current household size in the primary study area is 2.4 persons per household. Household size in the primary study area has been declining, the result of a transition to smaller families. In 1997, 347 single family homes were sold in Delta County, 176 fewer sales than in 1994. This decline in sales volume corresponds with slowing net in-migration of new residents. Average sales price of a single family home in Delta County varies by community. Highest priced homes can be found in the Cedaredge and Paonia areas.

The reported average sales price in the Paonia area has declined from $139,900 in 1995 to $89,800 in 1997. This also coincides with slowing net in-migration of new residents.

3.15.2.3 Demographic Characteristics

An estimated 11.7 percent of the residents living in the primary study area represent racial and ethnic minorities, above the proportion in secondary study area (at 9.9 percent), but well below statewide levels (at 21.0 percent). Hispanic residents represent the largest minority/ethnic group, accounting for 10.5 percent of Delta County's population.

Primary study area residents tend to be older than secondary study area residents. Almost 49 percent of primary study area residents are age 45 and older, compared to 41 percent in the secondary study area. The primary study area population also is aging. Over 69 percent of the population growth in the primary study area comes from persons aged 45 and older. Seniors (65+) account for 23 percent of all new residents.

3.15.2.4 Employment and Economic Conditions

Participation in the Delta County labor force is well below labor forces participation rates in the larger secondary study area and statewide. In 1997, only 50 percent of the population age 16 and older in Delta County was employed or actively seeking employment. In the secondary study area, 60 percent of residents age 16 and older were employed or seeking employment. As of April 1999, the unemployment rate in Delta County was 5.9 percent, more than twice the

statewide rate of 2.7 percent. Local unemployment consistently runs about 1½ to 2 percentage points above the statewide average.

Delta County population migration appears to closely parallel employment growth. Years of greatest net out-migration coincide with years of significant job losses, illustrating that when Delta County loses jobs, local population growth tends to slow or decline.

As noted above, while employment growth can influence population, the reverse situation where population growth influences employment opportunity can also occur. Communities offering high quality of life may draw in-migrants who then support local retail and service businesses. Some in-migrants may bring independent wealth and existing business or start a business, further boosting the local economy.

In 1996, approximately 11,370 workers were employed in Delta County (including self-employed). Employment has increased by almost 27 percent since 1980. Fastest-growing industries include services (+98 percent), wholesale trade (+78 percent), and construction (+62 percent). The only industries reporting a decrease in employment since 1980 are agriculture and farm (-20 percent), finance, insurance, and real estate (-23 percent), and mining industries (-65 percent).

As of 1996, self-employment is estimated to represent the largest single job sector in Delta County. Over 30 percent of all workers are self-employed (non-farm), a greater proportion than in the secondary study area or statewide. The number of non-farm self-employed workers increased by 21 percent between 1980 and 1996 in Delta County.

Over the last 17 years, the coal mining industry in Delta County, as well as in the secondary study area and statewide, has undergone a period of economic restructuring. In 1981, nine active coal mines produced almost 3.0 million tons of coal in the secondary study area (covering Delta and Gunnison counties), representing 15 percent of total production statewide.

By 1986, only three active mines remained producing 1.3 million tons of coal, representing only 8 percent of statewide production.

Since 1986, the coal mining industry in the secondary study area has rebounded. However, the primary production of coal has shifted towards Gunnison County. The two county secondary study area is now producing almost 30 percent of the state's coal.

Both Delta and Gunnison counties have experienced substantial employment growth from 1980 to1996. This overall employment growth has occurred even as mining-related employment has declined, leading to a more diverse economy in both the primary and secondary study areas. While mine employment has declined, mines have restructured to achieve substantially greater productivity in a more competitive domestic and global market.

3.15.2.5 Income

In 1996, personal income per capita in Delta County averaged $16,400 (after adjusting for inflation), 4 percent below the $17,000 per person living in the secondary study area and 36 percent below $25,700 average experienced statewide. Personal income is the amount of income an individual receives annually before taxes. It includes wages, salaries, proprietor's income, other labor income, investment income, and transfer payments. Between 1980 and 1996, personal income per capita in Delta County increased by 19 percent, compared to 24 percent in the secondary study area and 33 percent statewide.

As of 1996, residents in Delta County earn less in wages, salary and proprietor's income than from transfer payments (e.g., retirement, unemployment insurance, government payments) and investment income. Only 32 percent of personal income is from wage and salary sources, down from 36 percent in 1980.

In 1996, average wage per worker in Delta County was $15,700 compared to $17,100 in the entire secondary study area and $28,400 statewide. Highest-paid wages were in the mining sector where the average Delta County worker earned $47,600, more than three times the county wage average for all sectors and $18,400 above the next highest paying sector.

It is noted that reported income data alone does not necessarily provide a complete picture of economic activity in the study area. As noted by comments to the Draft EIS, residents of rural areas offering quality of life amenities such as scenery, low crime rates and recreational opportunities may accept lower incomes than residents of a more urban or lower amenity rural setting.

3.15.2.6 Community and Public Services

As part of the EIS process, area community and public service providers were contacted to ascertain information regarding current services provided together with possible public service effects due to prospective changes in mining activities in the Bowie and Somerset areas of Delta and Gunnison counties. This assessment focuses on the primary study area in Delta County, where the majority of mine employees currently reside.

County Governance - The primary study area consists of six incorporated communities, with the rural unincorporated portion of Delta County under the auspices of county government. The Iron Point Exploration License Area, the Iron Point Coal Lease Tract, and a portion of the Elk Creek Coal Lease Tract are situated in unincorporated Delta County. A portion of the Elk Creek Coal Lease Tract extends into unincorporated Gunnison County.

Education - Public education service providers in the primary study area include the Delta County Joint School District, the Gunnison Watershed School District and the Delta-Montrose Area Vocational Technical Center. Most children of current mine employees attend Delta County Joint School District schools. The Delta County Joint School District serves nearly 4,700 households in Delta County and portions of Montrose, Gunnison and Mesa counties with 14 schools and a vocational technology school.

Enrollment has not increased in the past 3 years. Overall, the 14 schools in the district are operating at 71 to 73 percent of the indicated 6,400 to 6,500 facility capacity. One school (Garnet Mesa Elementary) is at full capacity and another school (Hotchkiss Middle School) is operating at less than 50 percent of indicated enrollment capacity.

Area schools also provide services of importance to coal mines operating in Delta and Gunnison counties. The Delta-Montrose Area Vocational Technical Center, 5 miles south of Delta, provides training for emergency medical technicians (EMTs), paramedics, mine workers and OSHA certification.

Ambulance Services - Delta County ambulance service is divided between the North Fork Ambulance Service (serving Paonia, Hotchkiss and Crawford) and the Delta County Ambulance Service (serving Cedaredge, Orchard City and Delta). These ambulance services provide basic life support, emergency care, and transport.

To date, little direct impact to ambulance service reportedly has been experienced due to mine operations and associated unit train traffic. Generally, delays tend to last five to seven minutes; however, not all train crossings are blocked at the same time. Emergency vehicles typically can access unblocked crossings and go around the trains. To help minimize any serious delays due to possible train blockages, communities in the Delta County Ambulance District alternate the side of the rail line on which the ambulance is parked.

The Delta County Ambulance Service has no arrangement with the mines for service. Mines have on-site first aid staff or EMT personnel and ambulances.

Fire Protection - Each Delta County incorporated jurisdiction and of the unincorporated county is part of a fire district. Five fire districts serve the primary study area and the Somerset portion of Gunnison County.

Paonia Fire District 2 (closest to the North Fork mines) provides fire and rescue services to a population of approximately 5,000 in a 30,500-acre (48 square mile) area. Recent voter approval to double the mill levy indicates the community's commitment to and awareness of the services provided and needed.

Law Enforcement - A combination of county sheriff and city police departments provide law enforcement services in the primary and secondary study areas. The police forces of the towns of Paonia, Hotchkiss, Cedaredge and Delta work cooperatively with the Delta County Sheriff's Department, while the communities of Crawford and Orchard City rely completely on the Sheriff's Department because they do not have police departments of their own.

Water Supply, Wastewater Treatment and Solid Waste - Municipal water service is provided for each of the incorporated cities in the primary study area of Delta County. Municipal sewage and wastewater treatment is provided in all of the incorporated communities except Orchard City. In rural areas, with the exception of portions of the Paonia and Cedaredge rural areas, residents rely on private domestic or community water systems.

Delta County has an EPA-approved landfill in the Tongue Creek area, with a transfer station in the North Fork area. Solid waste service is available through private contractors in all communities.

Paonia's public works priority is to build a new sewage treatment plant to come into compliance with EPA regulations. The city is also studying additional water storage capacity.

Approximately 22 households in Somerset are on a sewage system, with the remainder of the community served by septic tanks. This sewage system is near capacity, and many households with septic tanks would like to come on the sewage system.

Crawford's lagoon is at 25 percent of capacity according to EPA standards, and the town is planning more water lines. The town is planning an expansion of the sewer ponds.

Hotchkiss water and sewer systems currently have capacity to serve added growth. With stricter EPA regulations and the anticipated need for more water storage, the town is currently conducting a water study. The study is due to be finished by the end of 1999.

Delta's sewage treatment plant is approximately 15 years old and operates well below available capacity. Delta buys water from the Project 7 water supply in Montrose. Project 7 treatment plant capacity is questionable. The plant was not built to meet new regulations, and Project 7 plans to expand the water treatment plant and to add storage.

In Orchard City, a new building for water filtration is under construction at an estimated cost of more than $750,000.

Cedaredge's updated water treatment plant is one of three national finalists for a national EPA award for Most Improved Small System Wastewater Treatment. The plant is near capacity, so the city is considering further enlargement updating or the construction of a new plant at a different location.

Hospital and Medical Services - Delta Hospital, in Delta, operates as a full-service, general acute care hospital with 49 beds, home health care, a staff of 28 doctors, and 198 full-time and 89 part-time employees. The hospital's primary service area comprises Delta County together with the communities of Olathe in Montrose County and Somerset in Gunnison County.

Electrical Utilities - Tri-State Power generates and sells power to 32 member stations throughout Colorado. These include Delta Montrose Electric Association and Gunnison Electric within the primary and secondary study areas. Delta Montrose Electric's service area includes East Montrose County, western Gunnison County, and all of Delta County. North Fork area mines are paying members of the Delta-Montrose Electric Association.

To accommodate operating mines, the co-op has made several changes over the years, such as upgrading Waunita, the substation located near Bowie that serves the North Fork mines. Delivery points and land taps were added.

Social Services - Delta County Social Services provides public assistance to low-income families and the elderly. Overall, case loads are decreasing except for assistance to the elderly which has been increasing.

Roads - In the Paonia-Hotchkiss-Crawford area, most of the truck traffic is not mine-related. Coal is primarily moved by train. The exception is truck traffic from the Bowie No. 2 Mine to the Bowie No. 1 Loadout. Highway 133 is considered a scenic route and is traveled by tourists.

According to a variety of local community and public service providers contacted for this socioeconomic assessment, train blockage represents an issue of concern related to current and prospective mine operations. For example, EMT service can be delayed five to seven minutes when crossings are blocked. See Section 3.14, Transportation, for a more thorough discussion.

3.15.2.7 Fiscal Conditions

The federal government receives revenue from land and mineral rights leases, as well as royalties. The State of Colorado receives tax revenues primarily from federal royalties, sales, severance, and income taxes. Local governmental entities receive property, sales, and severance taxes, as well as a share of the federal royalties.

State of Colorado Revenues - Net state and local revenue collections in Colorado totaled $6.3 billion in 1998. Severance tax, which gets redistributed back to local jurisdictions, accounts for only 1 percent of all Colorado tax collections statewide.

County Revenues and Expenses - Taxes represent 69 percent of total county revenues in Delta County and 64 percent of revenues in Gunnison County. Tax revenues also are increasing more rapidly than all revenues combined.

On the expenditure side, general governmental expenditures account for 55 percent of county expenditures in Delta County and 59 percent in Gunnison County. Growth of general governmental expenditure also is outpacing total expenditures in both counties. Education is the top expenditure in both Delta and Gunnison counties Public safety represents the number two expenditure item in both counties.

Retail Sales Tax - While Gunnison County has fewer permanent year-round residents than Delta County, the level of retail sales is higher in Gunnison County than Delta County, at $358.8 million versus $289.2 million respectively. Higher retail sales levels in Gunnison County are primarily due to a substantially larger tourism industry than Delta County.

Businesses within the City of Delta captured over $161 million worth of retail sales in 1998, representing 56 percent of all retail sales in Delta County.

Property Tax - In 1998, over $8.6 million in property taxes were collected in Delta County. Almost 48 percent came from residential properties, the largest source of property tax revenues. Total tax assessed valuation for Delta County (as of 1998) was $167.1 million.

In 1998, coal mines represented $5.7 million of Delta County assessed valuation and $31.5 million in Gunnison County for a combined valuation of $37.2 million. Railroads serving the coal mines within the secondary study area also constitute a major property tax revenue source. In 1998, their assessed Delta County value totaled $4.1 million.

Severance Tax - Colorado severance tax revenues are generally split 50/50 between the State Trust Fund and a Local Impact Fund.

In 1998, Colorado coal mines generated over $9.3 million in severance tax revenues. Since 1989, the long term trend in severance taxes paid in Colorado generally was up, but with significant year-to-year variations.

Because much of the mine activity is located outside the communities where mine employees live, Colorado has implemented a severance tax to help communities pay for services provided to mine employees. Based on state severance tax records, 278 mine employees live in Delta County. State severance tax records also showed that nearly 47 percent of these employees live in Paonia, which received almost $51,800 in severance taxes in 1998.

Federal Royalties - The royalty for underground coal mining on federal coal is 8 percent of the value of the coal. Fifty percent of these royalties are retained in the federal treasury. The other 50 percent is returned to the state from where the coal was extracted to help address impacts from the mineral development on federal lands. Royalty monies received by Colorado are further distributed as follows:

- 50 percent to the county where the coal was extracted (up to $200,000);
- 25 percent to the State School Fund;
- 15 percent to the Colorado Department of Local Affairs; and,
- 10 percent to the Colorado Water Conservation Board.

Depending on monies available and thresholds in the distribution formula, there may be a further redistribution under the Colorado statutes (CRS 34-63-102).

There is recognition amongst local governments that much of the coal mining in the North Fork Valley is conducted in Gunnison County while the majority of the impacts occur in Delta County. There is an inter-governmental agreement in place to help deal with this issue.

In 1998, coal mines in Delta County generated $742,400 in federal royalties. One-half of this amount was returned to Delta County. The mines in Gunnison County generated over $6.6 million in royalties; Gunnison County received one-half or $3.3 million.

Energy Impact Grant Program - An energy impact grant program is available to Colorado communities to fund projects ranging from bridges to recreation. Funds for this program are awarded on a competitive basis and come from a variety of sources. Available funds statewide totaled $12 million in 1998.

3.15.2.8 Recreation

Tourism plays a larger role in the Gunnison County economy than in Delta County because of mountain-oriented resort activity. Gunnison County has several resort communities, Crested Butte Ski Area being one of them.

In 1997, tourists spent nearly $21.4 million in Delta County. Over $130 million was spent by tourists in the entire secondary study area, 84 percent captured by Gunnison County.

Travel spending in Delta County generates about 380 jobs, half of which occurs with dining establishments. Average wage in the tourism sector is $10,200 per year, $5,500 less than the average wage for all Delta County workers. Approximately 1,920 jobs are supported by travel spending in the two-county secondary study area.

3.15.2.9 Social Values

By combining community and public service information with psycographic data, it is possible to arrive at several overall observations regarding social values of the Delta County rural communities most directly connected to current and potential future mining activities:

- Communities along the North Fork of the Gunnison River have a long history with coal mining extending back to the late 1800s; however, like much of the American West, the primary study area of Delta County is in transition both economically and culturally. Local communities are becoming more diversified with less dependence on coal mining as a source of income but with continued economic benefits from the relatively high-wage jobs associated with mining.

- The primary study area has not yet experienced the rapid in-migration occurring elsewhere in counties of Colorado's central western slope region; however, there is evidence of growing difference in social values of newcomers versus longtime residents. It is generally believed that newer residents are less supportive of traditional extractive natural resource activities which include ranching, farming, logging and mining.

- In Delta County, over 60 percent of households are identified with demographic and lifestyle characteristics of "rustic living." These households tend to come from a tradition and/or remain actively involved in making a living from the land, including agriculture, logging mining and construction. Households who fit in this "rustic living" category comprise only 17 percent of the central western slope and 5 percent of all Colorado households, and are therefore less likely to represent in-migrants to Delta County.

- A number of primary study area residents tend to value the economic opportunity represented by North Fork mining activity. However, expanded coal mining also

raises concerns of potential negative lifestyle effects. These concerns include issues such as train noise/crossing blockage, and effects of future temporary or permanent closures on mine workers, their families and affected communities.

- Whether or not coal mining is viewed as having a positive or negative effect on quality of life depends on the values that receive greatest emphasis from different residents of the North Fork region. Those who place greater emphasis on the economic stimulus and continued job opportunity presented by ongoing coal operations tend to be supportive of continued or expanded coal operations. Conversely, those who chose to reside in the area and to leave behind the hustle, bustle, noise and pollution of urban living and modern industrial society, raise questions or are less favorable to ongoing or expanded North Fork coal mine operations.

3.15.2.10 Land Ownership and Values

An estimated 56 percent of Delta County land is in public ownership with another 37 percent in agricultural use. Only 7 percent of all land is in non-agricultural private ownership. As of 1998, total assessed value in Delta County was $167.1 million.

Only 4 percent of Delta County's tax assessed valuation consists of natural resource related properties. These include mine properties.

3.15.3 Environmental Consequences

The socioeconomic effects discussed in this section consider information presented in Section 3.15.2, Existing Conditions. In addition, projections regarding mine production and operations were used for the impact analysis. Economic multipliers specific to the study area were derived from the IMPLAN economic model.

IMPLAN is an economic model providing information that identifies the relationships between multiple economic sectors at the county level. The model was developed for the Forest Service and draws on a national database from the U.S. Bureau of Economic Analysis and provides data for 528 economic sectors. The state of Colorado also has a regional input/output economic impact model (RMIS). This model only provides information for 38 aggregated industries by region. This Colorado model places Delta County in one region and Gunnison in the other region. This division and the greater level of economic sector detail are reasons that the IMPLAN model was used for assessing economic impacts in this EIS; however, data from the Colorado State Department of Local Affairs were incorporated into the analysis.

Direct and indirect socioeconomic impacts are evaluated for the two-county secondary study area. Fiscal effects are evaluated primarily in terms of direct consequences, as indirect effects are less readily quantified. Cumulative impacts are discussed primarily in the context of the larger seven-county tertiary study area.

Supplemental Analysis Incorporating LEIFA Data - In response to comments on the Draft EIS, a supplemental economic impact assessment was conducted to incorporate LEIFA data into the IMPLAN economic impact model. This analysis resulted in a separate set of economic impact multipliers that were driven LEIFA data.

The LEIFA data results in a lower by employment multiplier (2.4 vs 2.70) but a larger income multiplier (2.62 vs. 22.52) than is estimated for the Draft EIS and Final EIS using IMPLAN data. The lower employment multiplier is a direct result of LEIFA data recording higher levels of

agricultural employment offset somewhat by lower levels of employment in the health care, specialty retail, and some profession service sectors.

The higher income multiplier is a direct result of LEIFA data reporting $88.6 million less of earnings income in the two-county area than is indicated with the IMPLAN data set. In effect, the LEIFA adjusted model attributes less influence to coal mining on total area employment and more influence to two-county incomes in other sectors of the local economy than is estimated with the IMPLAN data set.

Since LEIFA results are within 10 percent of those generated from IMPLAN data, this supplemental analysis does not materially alter the Draft EIS conclusions regarding total employment or income supported by mining activity. A more detailed discussion of this supplemental analysis is provided in *Appendix L, Socioeconomic Report*, to the Final EIS.

The Draft EIS concluded that the action alternatives would lead to a maintenance of current conditions rather than to additional employment or income above and beyond what is currently experienced. This conclusion is not altered by the inclusion of the LEIFA data set.

3.15.3.1 Mine Development Assumptions

The principle difference between alternatives relates to the amount of coal reserves associated with each alternative. This affects the anticipated life of the existing mines. *Table 3.15-1, Total Projected Mine Life*, illustrates the estimated mine life for the alternatives.

Under Alternative A (No-Action Alternative), leases would not be issued for the Iron Point and Elk Creek Coal Lease tracts. Under this scenario, the Bowie No. 2 Mine has approximately 1.5 years of reserves, and the Oxbow operation has approximately 5 years of reserves.

Under Alternative B, an additional 5 years of reserves would be available for both the Iron Point and Elk Creek Coal Lease tracts at production rates discussed in Chapter 2.0, Alternatives Including the Proposed Action. With Alternatives C and D, approximately 8 years of additional reserves would be available for the Iron Point Coal Lease Tract and approximately 6 years for the Elk Creek Coal Lease Tract. Coal reserves available in Alternative D would be somewhat less than Alternative C because of the subsidence restrictions. However, this would not materially affect the projected mine life. For all of the action alternatives, access could be provided under Terror Creek to the reserves in the Bowie No. 1 pod. It is estimated that there are 2 years of reserves in the Bowie No. 1 pod. Mine life projections are estimates and can vary depending on factors such as fluctuating coal prices, inflation, lack of long-term coal contracts, and generally unpredictable future economic conditions.

Each mine anticipates additional capital expenditures for coal extraction with any of the Action Alternatives B, C, and D. The identified capital expenditures for both mines total an estimated $31 million.

For the Elk Creek Coal Lease Tract, it is anticipated that 30 to 40 construction workers would be needed to develop the Elk Creek portal and related facilities on Oxbow private surface. Construction should be completed in less than a year; therefore, any socioeconomic effects would be short–lived. For this construction work, there should be no need to attract new workers into the two-county study area.

Combined annual purchases for both mines are estimated at $49 million. It is anticipated that 20 percent of operating purchases annually would be made within the local study area.

Table 3.15.1 Total Projected Mine Life		
Alternatives	Mine Life (years)	
	Bowie No. 2[1/2]	Oxbow[1]
A[3]	1.5	5
B[4]	6.5	10
C[5]	9.5	11
D[6]	9	11

Notes:

1. For purposes of this table, it is assumed that coal reserves in the Iron Point Coal Lease Tract would be mined using the Bowie No. 2 Facility, and coal reserves in the Elk Creek Coal Lease Tract would be mined using the Oxbow facilities.
2. The estimates for the Bowie No. 2 column do not reflect the mine life for B seam reserves beneath the present Bowie No. 2 D seam mining or for the Bowie No. 1 "pod" of coal reserves, located to the west of Terror creek. Under Alternatives B, C, and D, it is assumed that the Bowie no. 1 "pod" reserves could be accessed through entries in the Iron Point Coal Lease Tract. Mining the Bowie No. 1 "pod" could add approximately 2 years to the life of the Bowie No. 2 operation.
3. Leases would not be issued for the Iron Point and Elk Creek Coal Lease tracts. Mine life illustrates remaining Bowie No. 2 and Oxbow reserves.
4. Assumes approximately 5 years of mine life for each lease tract, added to the projected mine lives of Alternative A.
5. Assumes multi-seam mining and expanded lease tracts. Estimated 8 years from Iron Point Coal Lease Tract and 6 years from Elk Creek Coal Lease Tract, both added to projected mine lives of Alternative A.
6. Similar to Alternative C, except with subsidence restrictions. Assumes loss of about 0.5 year of mining from Iron Point Coal Lease Tract due to subsidence restrictions. Coal reserves in the Elk Creek Coal Lease Tract could be somewhat less under Alternative D as compared to Alternative C, but not enough to affect projected mine life.

With Alternatives B, C, and D, operations employment at each mine is not anticipated to increase significantly above current conditions. This means the 168 mine workers at Bowie No. 2 (up from 157 people for room-and-pillar mining) and the 215 mine workers (mine workers and contract operators) at the Oxbow operations. These work forces would be assigned to the Iron Point and Elk Creek Coal Lease tracts respectively. With no anticipation of significant additional mine workers for these new lease tracts, population, housing and school enrollments should be unaffected compared to existing conditions.

Data from the IMPLAN model was used which identified an average annual wage for mineral extraction construction workers at $24,600. Estimated average annual wage during the period of mine operations is $59,500 per employee.

3.15.3.2 Socioeconomic Effects of Alternative A (No-Action)

Socioeconomic effects of the No-Action Alternative (Alternative A) would occur due to a reduction in coal mine activities within the local study area. Under a No-Action Alternative, mining of reserves at existing mines would continue at existing rates until reserves are depleted.

To be conservative, impacts associated with a No-Action alternative are expressed as maximum potential effects on an annual basis after cessation of existing operations at the Bowie and Oxbow sites.

Employment and Income - Combined effects of discontinuing operations at the existing Bowie No. 2 and Oxbow mines would represent loss of 383 jobs. Averaging $59,500 in annual salary, total lost payroll would approximate $22.8 million annually.

For every mine worker in the local study area, an estimated 1.7 workers are supported by mining operations and mine worker household purchases. If both mines were to close, then an estimated 650 locally supported non–mine jobs in Delta and Gunnison counties could potentially be negatively affected due to the drop in mining activity.

For every $1.00 earned by mine workers, another $0.52 in income is supported in the local study area. Closure of both mines could lead to a reduction of $11.9 million in non-mine related income throughout the affected study area.

Total direct and indirect mine closure effects could represent a loss of up to 1,033 jobs and over $34.6 million in annual operations payroll.

This no-action alternative would involve a level of reclamation employment and payroll after cessation of mine operations similar to that of the action alternatives. Combined, the existing Bowie and Oxbow operations could be expected to support over 210 direct plus indirect jobs and nearly $7.1 million in payroll annually during reclamation. After reclamation has been completed, on-going monitoring would occur at both of these facilities.

On a cumulative basis, if affected workers left the two-county study area, a substantial number likely would choose to remain within the broader seven-county central western slope area, as considerable inter-county migration occurs within the broader study area. According to IRS migration data for 1996–1997, almost 30 percent of residents leaving Delta County moved to other central western slope counties. Approximately 80 percent moved to neighboring Mesa and Montrose counties.

Housing, Population and School Enrollment - If both mines ceased operations, more than 800 residents (145 of school age) would be directly affected. Whether these children would remain enrolled in local schools would depend on whether parents choose to relocate elsewhere to find employment or remain in the local study area.

Combined, these two mine closures could affect nearly 2,380 residents living in the local study area, over 410 of them school–aged children.

If a significant portion of residents choose to migrate outside the area, the local housing market could experience at least a temporary downturn (e.g. decline in property values) because a large number of homes might come onto the market simultaneously, potentially driving down prices. Local schools also would be affected, as a substantial portion of students could eventually relocate outside of the district.

On a cumulative basis, with the No-Action Alternative, a significant portion of residents could be expected to relocate to other communities within the central western slope region. The number of low-income families living in the greater central western slope area could also increase.

Other Community and Public Services - Over a short-term period of job loss (with mine cessation), needs for some community and public services can be expected to increase. Examples are law enforcement and social services.

The economic multiplier relationship of direct to indirect employment could create further service demands from dislocation of workers currently supported by mining activity. A second

type of indirect effect would result from reduced local tax revenues as local incomes declined and/or property values decline, whether temporarily or longer term.

Community and public service providers would be affected by this combination of direct and indirect effects. If not offset by alternative sources of revenue, the level of service available from existing providers would decline.

On a cumulative basis, if alternative employment were not available to displaced mine workers, some households could be expected to relocate to other communities in the central western slope area. This could increase demands for community and public service providers in the communities affected.

Recreation, Social Values, Land Ownership and Values **-** Differing effects may be experienced, based on such factors as the perspective of a particular individual or social group, geographic area considered, and time elapsed from implementation of a No-Action Alternative.

Effects that might be expected are varied, potentially including:

- Reduced recreation from those displaced directly or indirectly by mining cessation, perhaps offset in part by those using recreation lands for hunting or fishing activity.

- Diminution in income levels and quality of life for those displaced directly or indirectly from mine closure.

- Potential enhancements in quality of life for some residents whose economic livelihood is not related in any substantial way to mining activity; a specific example would be reduced train activity and associated noise and crossing blockages.

- For at least the short-term, property values might decline if a substantial proportion of displaced workers decided to place their homes on the market and relocate from the area.

Over time, on a cumulative basis, cessation of mining would continue the trend toward in-migration of persons less dependent on traditional natural resource activities throughout Colorado's central western slope region. This could help stabilize property values in the long term.

Fiscal Effects **-** The state of Colorado and local jurisdictions in Delta and Gunnison counties currently receive an estimated $11.4 million in combined annual tax revenue related to operations of the Bowie No. 2 and Oxbow mines and mine-related employees. Of this amount, 52 percent accrues to state government and 48 percent to local governments in the secondary study area.

With cessation of mine operations, payment of tax revenues attributable directly to mine operations ($9.7 million annually) would cease. A portion of the remaining $1.7 million in taxes attributable to mine workers might continue to be received, depending on factors such as ongoing employment for reclamation, unemployment payments while workers are displaced, eventual ability to obtain re-employment, and need for relocation.

As stated in Section 3.15.2.7, Fiscal Conditions, local governments receive a share of the above revenues. Reduction in these revenues would place a burden on local government to provide services at levels that presently exist. With a decrease in revenues, these agencies may need to eliminate services, lower their level of service, or find alternate funding sources. In

addition, local government would lose a portion of the following estimated annual revenues: $5.7 million in federal royalties, $2.1 million in state severance tax, and $1.8 million in state sales tax.

3.15.3.3 Socioeconomic Effects Common to All Action Alternatives

Because no significant changes in mine employment are anticipated, socioeconomic effects are discussed in terms of continuing operations at the Iron Point and Elk Creek Coal Lease tracts. This means the socioeconomic effects discussed in this section should be viewed as a continuation of existing effects and not as new impacts to the local study area.

Employment and Income - The Elk Creek Coal Lease Tract anticipates the need for 35 construction workers for approximately a year of development of the Elk Creek portal and related facilities on Oxbow private surface. These workers are anticipated to earn $24,600, producing $861,000 in estimated payroll annually.

Total operations employment associated with the Iron Point and Elk Creek Coal Lease tracts combined would be estimated at 383 jobs with ongoing payroll of $22.8 million annually while both tracts are operational.

During periods when both mines are operating at the same time, these facilities are estimated to support over 1,000 direct and indirect jobs in the local economy and over $34.6 million in annual local income.

Combined, these facilities would support over 210 workers and income of nearly $7.1 million annually during reclamation. After reclamation has been completed, ongoing monitoring would occur at both of these facilities.

Housing, Population and School Enrollment - As with the employment and income effects, the housing, population, and school enrollment effects are presented as a continuation of existing effects and not as new impacts to the local study area.

Mining activities from the Iron Point and Elk Creek Coal Lease tracts would represent an estimated 350 households with 833 residents and 145 school age children during mine operations. This would decrease to 78 households with 185 residents (32 school age children) during the subsequent period of site reclamation.

During peak operations, the Iron Point and Elk Creek Coal Lease tracts would support an estimated, direct and indirect, 1,000 households translating into 2,380 residents with over 410 school age children. With reclamation, the number of households supported directly and indirectly by these mines would drop to just over 210 and 500+ residents with less than 90 school age children.

Other Community and Public Services - At maximum operations, annually recurring effects are expected to be similar for each of Action Alternatives B, C, and D. The primary difference is associated with anticipated duration of mine operations, with Alternatives C and D occurring over a longer time period than Alternative B.

During the period of mine operations, effects on community and public service providers generally could be expected to involve little to no change from current conditions. This is because mine operation employment associated with mining from the Iron Point and Elk Creek Coal Lease tracts would essentially be the same as at the existing Bowie and Oxbow

operations. Upon eventual cessation of mine operations, effects would be comparable to those identified with Alternative A.

On a cumulative basis, little or no change from current conditions would be attributed to lengthened duration of operations with Action Alternatives B, C, and D

Recreation, Social Values, Land Ownership and Values - With Alternatives B, C, and D, effects would include:

- Continued recreation opportunity for existing residents and visitors, but with some potential reduced opportunity for recreation on federal lands in the vicinity of the Iron Point and Elk Creek Coal Lease tracts.

- Maintenance of incomes, quality of life and social values of existing mine workers and other workers or businesses that benefit indirectly from mine-related activity.
- Potential diminution of quality of life and social values for some residents whose economic livelihood is not related in any substantial way to mining activity; a commonly cited example is increase train activity and associated noise and crossing blockage.

- No substantial change in property values or ownerships is expected due to mine operations over the period of their continuation.

Fiscal Conditions- During production from the Iron Point and Elk Creek Coal Lease tracts, state of Colorado and local jurisdictions in Delta and Gunnison counties would receive approximately $13.5 million annually in tax revenue. Of this amount, 52 percent accrues to state government and 48 percent accrues to local government in the secondary study area. In addition, mining on the two lease tracts would generate an estimated annual income of $5.7 million in federal royalties, $2.4 million in state severance tax, and $1.8 million in state sales tax. Taxes could fluctuate year-to-year as the mines acquire new equipment, make capital improvements, and as the values of such equipment and improvements depreciate. Taxes and royalties would also be influenced by factors such as the price of coal, coal markets, and mine employment.

Tax revenues and royalties would continue for the life of the mining. Upon project closure and reclamation, tax and royalty revenues would cease. Impacts would be similar to those described for Alternative A at that time.

3.15.3.4 Differences Amongst Action Alternatives

Total multi-year revenues to state and local governments are estimated at close to $70 million with Alternative B and $94 million with Alternatives C, and D. Multi-year revenues are 35 percent greater with Alternatives C and D than with Alternative B due to the longer duration of mining activity. The local government share of total revenues received is estimated at 51 percent with Alternative B and 53 percent with Alternatives C and D.

3.15.4 Cumulative Effects

On a cumulative basis, Alternatives B, C, and D would allow continued mining for a period of approximately 5 to 8 years beyond what is expected with Alternative A. It is conceivable that the life of affected North Fork mines could be extended further if operators successfully secure previously unmined seams on private lands or added federal leases.

Continued mining would generally maintain the existing social values of primary and secondary study area households that depend on or relate to natural resource-related industries.

The effect of increasing production on the Elk Creek Coal Lease Tract to 6 million tons per year could be a slight possible or negative impact depending on individual perspectives of the economic or social values.

3.15.5 Potential Socioeconomic Mitigation and Management

Potential and ongoing mitigation measures for socioeconomics are set forth in *Table 3.15-2, Potential Mitigation and Monitoring Measures for Socioeconomics.*

Table 3.15-2
Potential Mitigation and Monitoring Measures for Socioeconomics

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
SE-1	Minimize local unemployment	Employ local contractors and workers, use local job service centers, and go outside local area to hire only if qualified candidates are not available.	1	Mining Company
SE-2	Minimize accidents and promote mine safety	Implement miner safety and educational training.	1	MSHA Mining Company
SE-3	Identify and work collaboratively to solve local problems and concerns to the local community	Continue to work with local government and local organizations such as the North Fork Coal Working Group	1-2	Mining Company
SE-4[3]	Minimize discussion in the community	Collaborative resolution of community issues	1	NFCWG

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk Creek Coal Lease tracts, respectively.

SE-1 - Coal mining operators could, to the extent practicable, employ local contractors and workers, use the local job service centers, and only go outside the local area to hire if an adequate pool of qualified candidates can not be generated from the local area. This measure would be highly effective in minimizing local unemployment and maintaining a strong local economic base.

SE-2 - Coal mining operators, in conjunction and compliance with MSHA rules and regulations, would implement a variety of miner safety and educational training. The measures would be highly effective in promoting health and safety, and minimizing mine accidents that can injure workers, destroy property, and reduce productivity.

SE-3 - Coal mining operators would continue to work with local government and local organizations, such as the North Fork Coal Working Group. The measure would be effective in continuing the dialogue to understand and respond to diverse community interests and to serve as a forum for future discussion and communication amongst the mining companies and the community. Government officials, the mining companies, concerned citizens, and interested

organizations should continue their efforts to work together for the benefit of the local community as a whole.

3.16 LIGHT AND GLARE

Issue: *Minimize the impacts from lights when operating at night.*

3.16.1 Introduction

Several commentors were concerned about the lighting impacts from the facilities at the Bowie No. 1 Loadout, the Bowie No. 2 Mine, and the Sanborn Creek Mine.

3.16.2 Affected Environment

The Bowie No. 1 Loadout, the Bowie No. 2 Mine, and the Sanborn Creek Mine are existing operations. The light currently associated with these facilities result from the exterior safety lighting at the Bowie No. 1 Loadout and at the portal facilities of the Bowie No. 2 Mine and the Sanborn Creek Mine. Additional existing lighting is evident from nighttime vehicular traffic for employees and/or trucks.

The lighting from all three facilities is evident as one traverses State Highway 133 at night. The lighting at the Bowie No. 1 Loadout is also visible from portions of Garvin Mesa and Lamborn Mesa. The Bowie No. 2 Mine is not directly visible from Garvin Mesa or Lamborn Mesa, but some glow may be evident from the Bowie No. 2 portal facilities under certain conditions such as on cloudy nights.

Lighting from the Sanborn Creek Mine is visible as one travels State Highway 133 in the vicinity of the community of Somerset. Nighttime lighting from these Oxbow facilities are also visible to residents in Somerset.

3.16.3 Environmental Consequences

Light and glare from the existing operations can create a visible glow at night, depending on weather conditions. Lighting at the facilities is mounted on stationary structures. Low pressure sodium lights are the primary source of lighting.

3.16.3.1 Affects of Alternative A (No-Action)

There would be no additional impacts at the Bowie No. 1 Loadout, the Bowie No. 2 Mine, and the Sanborn Creek Mine as a result of the No-Action Alternative. Nighttime vehicular traffic, particularly coal trucks from the Bowie No. 2 Mine to the Bowie No. 1 Loadout, could increase as production rises from the 1998 permitted tonnage of approximately 2 million tons per year to the now permitted 5 million tons per year.

3.16.3.2 Affects Common to All Action Alternatives

No major additional light and glare impacts should result as a result of any of the action alternatives. As with the No-Action Alternative, nighttime vehicular traffic, particularly for coal trucks, would increase as the Bowie No. 2 Mine increases coal production to its current permitted level of 5 million tons per year. In the event that a new train loadout is constructed adjacent to the Bowie No. 2 Mine, this facility would be installed with mounted stationary lighting

structures, probably similar to the train loadout facilities at the Bowie No. 1 Loadout and at the Oxbow facilities near Somerset.

Lighting at these mining facilities could impact nighttime recreational activities, such as star gazing. In addition, some nearby residents, particularly those in Garvin Mesa that overlook the Bowie No. 1 Loadout, and residents in Somerset located adjacent to the Oxbow facilities, could be affected by the nighttime lighting.

3.16.4 Cumulative Effects

The extent of cumulative effects of nighttime light and glare is minimal. Lights are visible at the West Elk Mine surface facilities from State Highway 133. The combined lighting from the Oxbow facilities and that of Mountain Coal Company is visible as one travels westward along State Highway 133 between these two operations.

The effect on light and glare from increasing production on the Elk Creek Coal Lease Tract to 6 million tons per year would be minimal.

3.16.5 Potential Light and Glare Mitigation and Monitoring Measures

Mitigation measures for light and glare are set forth in *Table 3.16-1, Potential Light and Glare Mitigation Measures.*

Table 3.16-1
Potential Mitigation and Monitoring Measures for Light and Glare

Code	Impacts Mitigated	Potential Mitigation and Monitoring	Effectiveness[1]	Who[2]
LG-1[3]	Minimize off-site light and glare	Hood lights and direct lights toward center of project site. Use low-pressure sodium lights.	2	NFCWG

Notes:
1. Effectiveness is assessed as: 1 - highly effective; 2 - moderately effective; 3 - somewhat effective; and 4 - uncertain.
2. This is the entity with jurisdiction or authority to implement this action.
3. Issues being addressed by NFCWG. Mitigation is dependent on Bowie and Oxbow obtaining the Iron Point and Elk creek Coal Lease tracts, respectively.

3.17 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible resource commitments are those that can not be reversed (loss of future options), except perhaps in the extreme long-term. It relates primarily to non-renewable resources, such as coal or cultural resources, or those resources that are renewable only over long periods of time, such as mature vegetation or forests. The mining operation removes coal from the ground; this action results in an irreversible loss of the mineral resource.

Irretrievable resource commitments are those that are lost for a period of time. Examples are: the loss of production, harvest, or use of natural resources such as wildlife habitat or grazing use, until disturbed sites are reclaimed and revegetation success is achieved. For example: if a grazing allotment is in poor condition and is likely to remain so, the time gap between its current condition and its ideal (potential) productivity is an ongoing irretrievable loss. Because of the planned underground mining for the two coal lease tracts, disturbance would be a minimal; less than 1 percent of the lease areas would be affected by drill hole pads, borehole locations and ventilation shafts. During these uses, some existing grazing and wildlife habitat might be

disrupted during the estimated life of the mine and for a period thereafter. With reclamation of these disturbed sites, land uses would essentially return to current uses and levels of use or even be enhanced, but this could take a period of time for some resources such as mature aspen stands.

The irreversible and irretrievable effects of increasing production to 6 million tons of coal per year on the Elk Creek Coal Lease Tract would be minimal.

3.17.1 Irreversible Resource Commitment

The irreversible commitment of resources would include the consumption of non-renewable energy or materials, such as diesel fuel and gasoline, effects to topography, coal resources, and cultural resources.

The topography above the underground mining would be permanently altered by subsidence. The topographic changes created by subsidence would be mostly unnoticeable to the naked eye, as longwall subsidence tends to be uniform in nature (see *Appendix K, Subsidence Evaluation*). The result of subsidence is that the post-mining topography would be slightly lower than the original topography.

Fossil fuels used during the operation and transportation aspects of the coal mining on the two coal lease tracts would result in irreversible commitments.

The mining of the coal from the two lease tracts would be an irreversible use of the coal resource. On the other hand, however, the extraction and use of the coal would make this resource available for society.

Any soil or subsoil material not salvaged prior to disturbance could result in an irreversible commitment.

Any disturbance of cultural sites could result in an irreversible commitment. However, research values could be recovered prior to any physical loss.

3.17.2 Irretrievable Resource Commitment

Any vegetation removed in the areas of the proposed facilities would result in an irretrievable resource commitment. Similarly, such activity could displace wildlife within the direct area of disturbance (e.g., loss of habitat) and some wildlife within a larger area. Reclamation plans and mitigation measures would eventually return vegetation and restore wildlife habitat.

There would be a consumption of water resources during the duration of mining and changes caused by mining. Eventually the hydrology of the area would return to the similar condition that existed prior to mining.

Care in underground mine planning should be taken in order to avoid an irretrievable loss of possible future coal resources located adjacent to the proposed coal leases.

3.17.3 Unavoidable Adverse Effects

There are unavoidable impacts which could occur as a result of mining the coal on the two coal lease tracts. Some of these effects would be short-term, while others could be long-term.

These unavoidable effects could include:

- The generation of fugitive dust (short-term);
- The loss of vegetation and wildlife habitat (short and long-term);
- The consumption of water resources (short-term);
- The permanent alteration of topography by subsidence (long-term);
- The increased demand on public services and utilities (short-term);
- Loss of wetlands, springs and seeps, and changed functions and values of wetlands (short and long-term);
- Increases in noise levels which could affect human aesthetics (short-term); and
- Increased railroad and road traffic (short-term).

3.17.4 Short-Term Use Versus Long-Term Productivity

Short-term uses are those that generally occur on a year-to-year basis. Examples are wildlife and livestock use of forage, recreation, and use of the water resource. Long-term productivity is the capability of the land to provide resources, both market and non-market, for future generations.

Relationships between short-term uses of the environment and long-term productivity occur in all alternatives. Short-term uses such as mining may be said to represent irretrievable commitments of resources. As an example, the removal of vegetation from facility sites certainly prevents the vegetation from serving as forage for wildlife and livestock for a certain period of time. However, after a period of time, which would be based on the reclamation plan, vegetation would again reestablish and serve the desired purpose. This would occur because the basic long-term vegetative productivity would not be destroyed by the short-term use of mining; therefore, no irreversible damage would occur.

Coal mining operations on the two lease tracts would be short-term with mining and reclamation expected to last from a few years up to 10 years. The short-term use of the two federal coal lease tracts would be to recover as much coal as is economically feasible, while mitigating adverse impacts to acceptable levels.

Long-term productivity refers to the basic capability of the land to produce according to desired future levels (e.g., vegetation, wildlife habitat, water quality, etc.). Long-term productivity would depend on the reclamation measures applied, the ability to retain soil productivity, and the desired long-term management objectives.

All of the alternatives discussed in this EIS result in short-term uses which irretrievably commit certain resources. Proper reclamation and environmental mitigation should restore any disturbed sites to long-term productivity.

Chapter 4

Consultation and Coordination

4.0 CONSULTATION AND COORDINATION

Throughout the Environmental Impact Statement (EIS) scoping process, the Bureau of Land Management (BLM) and the U.S. Forest Service (Forest Service) contacted various federal, state, and local agencies for comments and concerns. These agencies include the following:

- U.S. Army Corps of Engineers;
- Environmental Protection Agency;
- U.S. Fish and Wildlife Service;
- Western Area Power Administration;
- Colorado Division of Minerals and Geology;
- Colorado Department of Wildlife;
- Colorado Division of Air Pollution Control;
- Colorado Water Quality Control Division;
- Colorado Division of Wildlife;
- Delta County; and,
- Gunnison County.

All of these agencies were invited to attend the public scoping meeting held in Hotchkiss, Colorado on April 21, 1999. Representatives of the Colorado Division of Minerals and Geology (DMG), Delta County, and Gunnison County were in attendance at this April 21, 1999 public scoping meeting.

A special meeting was held for those agencies interested in the North Fork Coal EIS on Thursday, April, 22, 1999. Representatives of the Colorado DMG, Colorado Division of Wildlife, Delta County, and Gunnison County attended this "interested agency" meeting. A tour of both the Bowie Resources Ltd. and Oxbow Mining facilities was conducted on this same day for interested agency personnel.

On Wednesday, April 28, 1999, BLM met with representatives of the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service in Grand Junction, Colorado, to discuss the North Fork Coal EIS.

The BLM also met with representatives of the Environmental Protection Agency in Denver, Colorado on Tuesday, May 18, 1999.

The Final EIS will be distributed to a number of government agencies. The tentative list of agencies to receive the Final EIS are listed below. The number of copies needed is also listed.

Copies of EIS

ADVISORY COUNCIL ON HISTORIC PRESERVATION

Office of Architectural and Environmental Preservation
Advisory Council on Historic Preservation
1100 Pennsylvania Avenue, NW, Room 809
Washington, DC 20004 202-786-0505 1

AGRICULTURE, U.S. DEPARTMENT OF

Office of Equal Opportunity U.S. Department of Agriculture, Room 1345 Washington, DC 20250	202-447-5681	1
Animal & Plant Health Inspection Service PPQ (APHIS) Program Planning Staff U.S. Department of Agriculture Federal Building, Room 643 Hyattsville, MD 20782	301-436-8247	1
Rural Electrification Administration Assistant Administrator for Management U.S. Department of Agriculture, Room 4063 Washington, DC 20250	202-382-9552	1
Soil Conservation Service Environmental Coordinator of Ecological Sciences Division U.S. Department of Agriculture, Room 6155 P.O. Box 2890 Washington, DC 20013	202-447-4912	1
USDA Coordinator National Agricultural Library, USDA 10301 Baltimore Boulevard USA Publications, Room 002 Beltsville, MD 20705	301-344-3755	2
U.S. Department of Agriculture Room 102-W Washington, DC 20250	202-447-5681	5
USDA OPA Publications Stockroom Room A-325 (Attic) South Building Washington, DC 20250		1
Forest Supervisor Grand Mesa, Uncompahgre and Gunnison National Forests 2250 Highway 50 Delta, CO 81416	970-874-6649	5
Paonia Ranger District P.O. Box 1030 Paonia, CO 81428	970-527-4131	5

USDA Forest Service Attention: Environmental Coordinator Rocky Mountain Region 740 Simms P.O. Box 25127 Lakewood, CO 80225	303-236-9341	5
COMMERCE, U.S. DEPARTMENT OF		
National Oceanic and Atmospheric Association Ecology and Conservation Division Room 5808 Herbert Hoover Building Washington, DC 20230	202-377-8565	1
DEFENSE, U.S. DEPARTMENT OF		
Chairman, Department of Defense Explosive Safety Board 2461 Eisenhower Avenue Alexandria, VA 22331	703-352-0969/703-352-0891	1
Deputy Assistant Secretary of Defense (Environment) Room 3D833, Pentagon Washington, DC 20301-0800	202-695-7820	2
Deputy Assistant Secretary of the Air Force (Environment, Safety & Occupational Health) SAF/RQ Washington, DC 20330-1000	202-697-0800	1
U.S. Army Corps of Engineers Regulatory Branch 402 Rood Avenue, Room 142 Grand Junction, CO 81501	970-243-1199	1
U.S. Army Corps of Engineers Sacramento District 1325 J Street Sacramento, CA 95814-2922		2
U.S. Army Engineering and Housing Support Center Attention: CEHSC-E 20 Massachusetts Avenue, NW Washington, DC 20314-1000	202-272-0591	2
ENVIRONMENTAL PROTECTION AGENCY		
Environmental Protection Agency EIS Review Coordinator Region VIII 999 18th Street, Suite 500 Denver, CO 80202-2466	303-312-6002	5

EPA - Office of Federal Activities Mail Code 2252A 401 "M" Street, SW Washington, DC 20460	202-260-5076	5
ENERGY, U.S. DEPARTMENT OF		
Office of NEPA Project Assistance EH-25/MSGB096A U.S. Department of Energy Washington, DC 20585	202-586-4600	3
FEDERAL HIGHWAY ADMINISTRATION		
Western Resource Center Federal Highway Administration 201 Mission Street, Suite 2100 San Francisco, CA 94105	415-744-3102	1
GENERAL SERVICES ADMINISTRATION		
Environmental Staff General Services Administration 18th and F Street, NW, Room 6323 (Code PLPP) Washington, DC 20405	202-708-5082	2
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Library of Congress Madison Building Exchange of Gifts Division Federal Documents Section "C" Street, Between 1st and 2nd, SE Washington, DC 20540		15
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Office of Special Programs Coordination U.S. Department of Health and Human Services Office of the Secretary 303 Independence Avenue, SW, Room 4700 Washington, DC 20201	202-245-7426	1
INTERIOR, U.S. DEPARTMENT OF THE		
Bureau of Land Management Colorado State Office 2850 Youngfield Street Lakewood, CO 80215		5

Bureau of Land Management Uncompahgre Field Office 2465 S. Townsend Avenue Montrose, CO 81401		5
Bureau of Land Management NARSC-Library P.O. Box 20457 Building 50, Denver Federal Center Denver, CO 80225		1
Bureau of Land Management 1849 C Street NW Washington, DC 20240		1
Office of Surface Mining Western Regional Coordinating Center 1999 Broadway, Suite 3410 Denver, CO 80202	303-844-1400	5
Director, Office of Environmental Project Compliance U.S. Department of the Interior Main Interior Building MS 2340 1849 C Street, NW Washington, DC 20240	202-343-2116	5
Natural Resource Library Main Interior Building, Room 1041 1849 C Street NW Washington, DC 20240		3
U.S. Fish and Wildlife Service 764 Horizon Drive, South Annex A Grand Junction, CO 81506	970-243-2778	1

INTERSTATE COMMERCE COMMISSION

Chief, Section of Energy and Environment Interstate Commerce Commission Room 3115 Washington, DC 20423	202-275-7316	1

TRANSPORTATION, U.S. DEPARTMENT OF

Assistant Secretary for Policy and International Affairs U.S. Department of Transportation Environmental Division (P-14), Room 9217 400 7th Street, SW Washington, DC 20590	202-366-4366	2

COLORADO DEPARTMENT OF NATURAL RESOURCES		
Division of Minerals and Geology 1313 Sherman Street, Room 215 Denver, CO 80203	303-866-3567	2
Colorado Division of Wildlife P.O. Box 426 Paonia, CO 81428	970-527-4419	1
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT		
Air Pollution Control Division 4300 Cherry Creek Drive South Denver, CO 80246	303-692-3168	1
Water Quality Control Division 4300 Cherry Creek Drive South Denver, CO 80246	303-692-2000	1
COLORADO STATE ENGINEER		
1313 Sherman Street, Room 818 Denver, CO 80203	303-866-3581	1
COLORADO DEPARTMENT OF TRANSPORTATION		
Environmental Review 4201 E. Arkansas Avenue Denver, CO 80222	303-757-9259	1
Access & Utility Coordination 606-S. 9th Street Grand Junction, CO 81501	970-248-7234	1
DELTA COUNTY		
Planning Department 501 Palmer Delta, CO 81416	970-874-2106	2
GUNNISON COUNTY		
Planning Department 200 E. Virginia Gunnison, CO 81230	970-641-0360	2

Chapter 5

List of Preparers

5.0 LIST OF PREPARERS

5.1 INTRODUCTION

The Bureau of Land Management (BLM) and the U.S. Forest Service (Forest Service) are the joint lead agencies for the North Fork Coal Environmental Impact Statement (EIS) and are responsible for the contents of this EIS document. The Office of Surface Mining (OSM) is a cooperating agency on this EIS project. S. Edwards Inc. served as the third-party EIS contractor under the direction of the lead agencies and utilized numerous subcontractors in the assemblage of the EIS. A number of individuals have contributed to this document. The academic background and experience of these individuals are presented in this chapter.

5.2 BUREAU OF LAND MANAGEMENT

Jerry Jones - Environmental Coordinator: BS in Geology, Southern Colorado State University. 27 years professional experience. EIS Project Manager.

Dennis Murphy - Hydrology and Soils: BS in Forestry-Watershed Science, Utah State University. 21 years professional experience, hydrology and soils.

Lynn Lewis - Geology: BS in Geology, 1976, University of Wyoming. 22 years experience.

Desty Dyer - Mining Engineer: BS in Mining Engineering, Colorado School of Mines. 23 years of experience in private and government service.

Jeanette Pranzo - Socioeconomics: MA in Economics, University of Pittsburgh. BA Hunter College. 28 years experience.

5.3 U.S. FOREST SERVICE

Jeff Burch - NEPA Compliance: MS and BS in Forestry, Colorado State University. Post Graduate course work in Environmental Planning. 23 years professional experience. NEPA Process Advisor.

Andrea Wang - Wildlife Biologist: BA in Biology, Western State College. 15 years experience.

Sally Crum - Cultural Resources: BA in Anthropology. 20 years professional experience. Archaeology.

Liane Mattson - Geology, Hydrology, Subsidence: BS Geological Engineering, Colorado School of Mines. 11 years of experience in private and government service.

5.4 OFFICE OF SURFACE MINING

Floyd "Mac" McMullen - EIS Coordinator: MS in Environmental Science, 1988, University of Colorado at Denver. BS in Range-Forest Management, 1974, Colorado State University. 10 years with BLM, 15 years with OSM.

Larry Kline - Federal Lands State Coordinator: MS in Rangeland Ecology, 1974, Utah State University. BA in Zoology, 1967, University of Colorado, Boulder. 10 years experience in the private sector, 16 years with OSM. Experience in the environmental aspects of coal mining.

5.5 S. EDWARDS INC.

Sally Edwards - Principal in Charge: MS in Resource Management, 1991, Colorado State University, and BS in Forestry 1976, Colorado State University. Experience in project management of environmental analyses. Experience in forestry in western and southern United States. 13 years with Forest Service, five of which served as District Ranger. President of S. Edwards Inc.

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5.6 S. EDWARDS INC. PRIMARY CONSULTANTS

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Chapter 6

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Chapter 7

Glossary

7.0 GLOSSARY

A

AAQS: Ambient Air Quality Standards (set by EPA based on Federal Clean Air Act).

Acre-foot: The amount of water or sediment volume which covers an acre of land to a depth of one foot; an acre-foot is equal to 325,851 gallons or 43,560 cubic feet.

ADT: Average daily traffic - a measure of traffic over a 24-hour period. Determined by counting the number of vehicles (from both directions) passing a specific point on a given road.

Aerial: Consisting of, moving through, found, or suspended in the air.

Affect: To conduct an activity which will impact land, air, or water resources, so as to disturb the natural land surface.

Affected environment: A physical, biological, social, and economic environment within which human activity is proposed.

Alluvium: Unconsolidated sedimentary material (including clay, silt, sand, gravel, and mud) deposited by flowing water.

Alternatives: The different means by which objectives or goals can be attained. One of several policies, plans, or projects proposed for decision-making.

Ambient: The environment as it exists at the point of measurement and against which changes (impacts are measured).

Ambient air quality standard: Air pollutant concentrations of the surrounding outside environment which cannot legally be exceeded during fixed time intervals within specific geographic areas.

Ambient noise level: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

Angle of draw: The angle that defines the limit of surface subsidence. It is measured as the angle from a vertical projection from the edge of underground coal extraction limit.

ANC: Acid neutralization capacity.

APCD: Air Pollution Control Division of the Colorado Department of Public Health and Environment.

APEN: Air Pollution Emission Notice.

Aquatic: Growing, living in, frequenting, or taking place in water; in the Environmental Impact Statement, used to indicate habitat, vegetation, and wildlife in fresh water.

Aquifer: A zone, stratum, or group of strata acting as a hydraulic unit that stores or transmits water in sufficient quantities for beneficial use.

Aquitard: A confining bed that retards but does not prevent the flow of water to or from an adjacent aquifer; a leaky confining bed. It does not readily yield water to wells or springs, but may serve as a storage unit for groundwater.

Areal: The special extent or location.

Artifact: An object made or modified by humans.

Aspect: The direction toward which a slope faces.

Attachment area: A geographic region with which National Ambient Air Quality Standards (NAAQS) are met; three categories of attainment are defined as Class I, Class II, and Class III on the basis of the level of degradation of air quality which may be permitted.

Audible: Capable of being heard.

B

BA: Biological Assessment - Refers to the information prepared by or under the direction of the federal agency concerning listed and proposed species and designated and proposed critical habitat that may be present in the action area and the evaluation of potential effects of the action on such species and habitat.

Base flow: A sustained or fair-weather flow of a stream.

Baseline data: Data gathered prior to the proposed action to characterize pre-development site conditions.

BE: Biological Evaluation - Refers to the information prepared by or under the direction of the Forest Service concerning listed and Regional Forester Sensitive Species that may be present in the action area and the evaluation of potential affects of the alternatives on such species and habitat.

BEA: U.S. Bureau of Economic Analysis.

Best Management Practices: Management actions that are designed to maintain water quality by preventative rather than corrective means.

Big game: Large animals hunted, or potentially hunted, for sport. These include animals such as deer, bear, elk, bobcats and mountain lions.

Biological Opinion: A document that states the opinion of the USDI Fish and Wildlife Service as to whether or not the federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

BLM: Bureau of Land Management - The agency of the United States Government, under the Department of the Interior, responsible for administering certain public lands of the United States.

Bond: A sum of money which, under contract, one party pays another party under conditions that when certain obligations or acts are met, the money is then returned; such as after mining reclamation occurs. Also referred to as performance security. See "reclamation guarantee."

BTU: British Thermal Unit - The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

C

Capability: The potential of an area of land to produce resources, supply goods and services, and allow resource users under an assumed set of management practices at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as the application of management practices.

CCDC: County Citizens of Delta County.

CDOT: Colorado Department of Transportation.

CEQ: Council on Environmental Quality - An advisory council to the President of the United States; established by the national environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

CFR: Code of Federal Regulations - A codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government.

Cfs: Cubic feet per second - 1 cfs equals 448.33 gallons per minute.

CISPM: Comprehensive and Integrated Subsidence Prediction Model.

Coal exploration: The field gathering of surface or subsurface geologic, physical, or chemical data by mapping, trenching, drilling, geophysical, or other techniques necessary to determine the quality and quantity of coal in an area.

Coal waste rock: Waste rock is the non-coal material that is removed while mining. It contains no coal or coal below the economic cutoff level, and must be removed as part of mining.

Colluvium: Soil material or rock fragments moved down slope by gravitational force in the form of creep, slides, and local wash.

Concern: A point, matter, or questions raised by management or the public that must be addressed in the planning process.

Crucial winter range: Those areas which, during the winter months, determine a population's ability to maintain and reproduce itself at a certain level over the long-term.

Cultural resources: The remains of sites, structures, or objects used by humans in the past, historic or prehistoric. More recently referred to as heritage resources.

Cumulative effects or impacts: Cumulative effect or impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taken place over a period of time (40 CFR 1508.7 - these regulations use effects and impacts synonymously). For example, the impacts of a proposed

timber sale and the development of a mine together result in cumulative impacts.

D

DB: Decibel scale.

dBA: Decibel - A unit of expressing the relative intensity (loudness) of sound (decibel or dBA), weighted along the audible frequencies.

DBH: Diameter of a tree at breast height (four feet, six inches from ground level).

Decision-makers: The agencies, or designated representatives within the agencies, who must make the final decisions based upon the information presented in this Environmental Impact Statement.

Decommissioning: Suspension and/or closure of operations and possible removal of facilities.

Demography: A statistical study of the characteristics of human populations with reference to size, density, growth, distribution, migration, and effect on social and economic conditions.

Density: The number of individuals in a given area. Expressed per unit area.

Deposit: A natural accumulation, such as precious metals, minerals, coal, gas, oil, etc. that may be pursued for its intrinsic value; coal deposit.

Detection limit: The lowest concentration of a chemical that can be reliably reported to be different from zero concentration. Various analytical instrumentation has different detection limits.

Dewatering: To remove water from the coal seam.

Dilution: The act of mixing or thinning, and therefore decreasing a certain strength or concentration.

Dip: The angle at which rock stratum, veining, or any plane (fault) is included from a horizontal plane.

Direct impacts: Impacts which are caused by the action and occur at the same time and place.

Discharge: The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second, million gallons per day, gallons per minute, or cubic meters per second.

Diversion: Removing water from the natural course or location, or controlling water in its natural course or location, by means of a ditch, canal, flume, reservoir, bypass, pipeline, conduit, well, pump, or other structure or device.

Draft EIS: The draft state of environmental effects which is required for major federal actions under Section 102 of the National Environmental Policy Act, and released to the public and other agencies for comment and review.

Drilling: Exploratory action conducted to gather subsurface geologic, physical, or chemical data to determine the location, quantity, or quality of the natural mineral deposit on an area, including holes drilled for use as water wells.

E

EA: Environmental Assessment.

Effects: "Effect" and "impact" are synonymous as used in this document. Environmental changes resulting from a proposed action. Included are direct effects, which are caused by the action and occur at the same time and place, and indirect effects, which are caused by the action and are later in time or further removed in distance, but which are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems.

EIS: Environmental Impact Statement - An analytical document prepared under the National Environmental Policy Act that portrays potential impacts to the environment of a proposed action and its possible alternatives. An EIS is developed for use by decision-makers to weight the environmental consequences of a potential decision.

Employment: Labor input into a production process, measured in the number of person-years or jobs. A person-year is approximately 2,000 working hours by one person working year long or by several persons working seasonally. The number of jobs required to produce the output of each sector. A job may be one week, one month, or one year.

Endangered species: Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior or endangered in accordance with the 1973 Endangered Species Act.

Environment: The physical conditions that exist within the area that will be affected by a proposed project, including land, air water, minerals, flora, fauna, ambient noise, and objects of historical or aesthetic significance. The sum of all external conditions that affect an organism or community to influence its development or existence.

EPA: Environmental Protection Agency - An agency of the Executive Branch of the Federal Government which has responsibility for environmental matters of national concern.

Ephemeral stream: A stream or portion of a stream that flows only in direct response to precipitation or snow melt. Such flow is usually of short duration.

Erosion: The wearing away of the land surface by running water, wind, ice, or other geologic agents, including gravitation creep.

Exploration: The search for economic deposits of minerals, gas, oil or coal through the practices of geology, geochemistry, geophysics, drilling, shaft sinking, and/or mapping.

F

Fault: Displacement of rock along a sheer surface or liner plane.

Feasible: Capable of being accomplished in a successful manner within a reasonable period of time,

taking into account economic, environmental, legal, social, and technological factors.

Feasibility Study: As applied to mining, the feasibility study follows discovery of the mineral and is prepared by the mining company or an independent consultant. Its purpose is to analyze the rate of monetary return that can be expected from the mine at a certain rate of production. Based on this study, the decision by the company to develop the ore body may be made.

Final EIS: Means a detailed written statement as required by Section 102(2)(C) of the National Environmental Policy Act (40 CFR 1508.11). It is a revision of the draft Environmental Impact Statement to include public and agency comments to the draft.

Fisheries habitat: Streams, lakes, and reservoirs that support fish populations.

Fishery: All activities related to human harvest of a fisheries resource.

FLPMA: Federal Land Policy and Management Act.

Forest Plan: Each of the national Forests administered by the Forest Service is operated under a "Land and Resource Management Plan" as required by the National Forest management Act of 1976. The 1976 Act was an amendment to the Multiple Use Sustained Yield Act of 1960 and the Forest and Rangeland Renewable Resources Planning Act of 1974. Forest Plans are prepared under the authority of these acts.

Forest Service: An agency of the United States, under the Department of Agriculture, responsible for administering certain public lands (Forest System Lands) of the United States.

FTA: Federal Transit Administration.

Fugitive dust: Dust particles suspended randomly in the air, usually from road travel, excavation, and /or rock loading operations.

G

Game species: Any species of wildlife or fish for which seasons and bag limits have been prescribed and which are normally harvested by hunters, trappers, and fishermen under state or federal laws, codes and regulations.

Geohydrology: Refers to the hydrologic or flow characteristics of subsurface waters. Often interchangeable with hydrogeology.

Geotechnical engineering: A branch of engineering that is essentially concerned with the engineering design aspects of slope stability, settlement, earth pressures, bearing capacity, seepage control, and erosion.

GMUG: Grand Mesa, Uncompahgre and Gunnison.

Gpd, gph, gpm: Gallons per day, gallons per hour, gallons per minute.

Groundwater: Water found beneath the land surface in the zone of saturation below the water table.

Growth media: All materials, including topsoil, specified soil horizons, vegetative debris, and organic water, which are classified as suitable for stockpiling and/or reclamation.

Guidelines: An indication or outline of policy or conduct; (i.e., any issuance that assists in determining the course of direction to be taken in any planned action to accomplish a specific objective.

H

Habitat: The natural environment of a plant or animal, including all biotic, climatic, and soil conditions, or other environmental influences affecting living conditions. The place where an organism lives.

Habitat capability: The estimated ability of an area, given existing or predicted habitat conditions, to support a wildlife, fish or plant population. It is measured in terms of potential population numbers.

Habitat effectiveness: Degree to which a physical wildlife habitat is free from man-caused disturbances, and therefore attractive to wildlife occupancy.

Haul road: A road used by large (typically off-highway) trucks to haul ore and overburden from a mine to other locations, such as a mill facility or waste rock disposal area.

Hydraulic conductivity: A measure of the ability of rock or soil to permit the flow of groundwater under a pressure gradient; permeability.

Hydrologic system: All physical factors, such as precipitation, stream flow, snowmelt, groundwater, etc., that effect the hydrology of a specific area.

I

ID Team: Interdisciplinary Team - The interdisciplinary team is comprised of a group of personnel with different training assembled to solve a problem or perform a task. The team will consider problems collectively, rather than separate concerns along disciplinary lines. The interaction is intended to insure systematic, integrated consideration of physical, biological, economic, environmental design arts and sciences.

Impermeable: Property of a substance that inhibits passage of fluids through its mass.

IMPLAN: Impact Analysis for Planning - A comprehensive and detailed database covering the entire United States, broken down by county and in some cases down to zip code level. IMPLAN is primarily used for assessing potential impacts to a community due to changes in the local economy. Originally developed through a cooperative between the USDA Forest Service, Federal Emergency management Agency, BLM, and the University of Minnesota. Currently, the database is maintained in Minnesota IMPLAN Group, Inc.

Impoundment: The collection and confinement of water in a reservoir or other storage area.

Increment: The amount of change from an existing concentration or amount, such as air pollutant concentrations.

Indirect impacts: Impacts which are caused by the action but are later in time or father removed in distance, although still reasonably foreseeable.

Infiltration: The movement of water or some other fluid into the soil through pores or other openings.

Informal consultation: An optional process that includes all discussions, correspondence, etc. between the USDI Fish and Wildlife Service and another federal agency or the designated non-federal representative prior to formal consultation, if required.

Infrastructure: The underlying foundation or basic framework; substructure of a community (i.e., schools, police, fire services, hospitals, water and sewer systems).

Intermittent stream: A stream that runs water in most months, but does not contain water year-round.

Irretrievable: Applies primarily to the use of non-renewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.

Irreversible: Resource commitments that can not be reversed except perhaps in the extreme long term.

Issue: A point, matter, or question of public discussion or interest to be addressed or decided through a planning process.

J

Jeopardy or jeopardize the continued existence of: Means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species. A jeopardy opinion would result in the USDI Fish and Wildlife Service developing reasonable and prudent alternatives for the proposed action.

Jurisdictional wetland: A wetland area delineated and identified by specific technical criteria, field indicators and other information for purposes of public agency jurisdiction. The U.S. Army Corps of Engineers regulate "dredging and filling" activities associated with jurisdictional wetlands. Other federal agencies that can become involved with matters that concern jurisdictional wetlands include the USDI Fish and Wildlife Service, the Environmental Protection Agency, and the natural Resource Conservation Service.

K

L

Land management: The intentional process of planning, organizing, programming, coordinating, directing, and controlling land use actions.

Land Management Plan: See "Forest Plan."

Land status: The ownership status of lands.

LBA: Lease -by-application.

Lead agency: In NEPA (40 CFR 1501.5), the agency(s) with main responsibility for complying with NEPA procedural requirements, such as supervising the preparation of an Environmental Impact Statement.

Leaseable minerals: Minerals such as coal, oil shale, oil and agas, phosphate, potash, sodium, geothermal resources, and all other minerals that may be acquired under the Mineral Leasing Act of 1920, as amended.

Lease: A document through which interests are transferred from one party to another, subject to certain rights, obligations, and considerations.

LEIFA: Local Economic Information Forecasting Assistance.

Listed species: Species that are listed as threatened or endangered under the Endangered Species Act of 1973 (as amended).

Long-term impacts: Impacts that normally result in permanent changes to the environment. An example is a topographic change resulting from tailings disposal in a drainage. Each resource, by necessity, may vary in its delineation of long-term.

Longwall mining system: A mining system which utilizes a shearing device with two rotating drums for cutting coal, a self-propelled hydraulic roof support, and a conveyor to continuously mine coal.

LRMP: Land and Resource Management Plan.

M

Magazine: A storage facility for explosives. Magazines are built to specifications set by the Mine Safety and Health Administration and are usually located in a secure but remote area of a mine site.

Management activity: An activity of man imposed on a landscape for the purpose of harvesting, traversing, transporting, or replenishing natural resources.

Management area: An area with similar management objectives and a common management prescription.

Management direction: A statement of multiple use and other goals and objectives, and the associated management prescriptions, and standards and guidelines for attaining them (36 CFR 219.3).

Mean: A statistical value calculated by dividing the sum of a set of sample values by the number of samples. Also referred to as the arithmetic mean or average.

Mine facilities: Those structures and areas incidental to the operation of the mine, including mine offices, processing facilities, mineral stockpiles, storage facilities, shipping, loadout and repair facilities, and utility corridors.

Migratory: Moving from place to place, daily or seasonally.

Migration: Migration includes: (a) avoiding the impact altogether by not taking a certain action or parts

of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance of operations during the life of the action; and, (3) compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

MOA: Memorandum of Agreement.

Monitoring and evaluation: A watching, observing or checking, in this instance, a testing of specific environmental parameters and of project waste streams for purposes of comparing with permit stipulations, pollution control regulations, mitigation plan goals, etc. The periodic evaluation of management practices on a sample basis to determine how well objectives have been met.

MOU: Memorandum of Understanding - Usually documenting an agreement reached amongst federal agencies.

MSHA: Mine Safety and Health Administration - Federal agency under the Department of Labor which regulates worker health and safety in mining operations.

Multiple use: The management concepts under which National Forest and BLM lands are managed. The management of the lands and their various resource values so they are utilized in the combination that will best meet the present and future needs of the American people.

MUSYA: Multiple-Use Sustained Yield Act.

N

NAAQS: National Ambient Air Quality Standards.

NADP: National Atmospheric Deposition Program.

National Forest Land Resource Management Plan: A plan which "...shall provide for multiple use and sustained yield of goods and services from the National Forest System in a way that maximizes long-term net public benefits in an environmentally sound manner." (36 CFR 219).

NCB: National Coal Board.

NEPA: An act declaring a national policy which encourages productive and enjoyable harmony between humankind and the environment, promotes efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the nation, and establishes a Council on Environmental Quality (The Principal Laws Relating to Forest Service Activities, Agriculture Handbook No. 453, USDA, Forest Service, 359 pp).

NEPA process: Measures necessary to comply with the requirements of Section 2 and Title I of the National Environmental Policy Act.

NFCWG: North Fork Coal Working Group. A community based group formed to deal with growth issues related to coal mining in the North Fork Valley.

NFMA: National Forest Management Act - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring the preparation of Regional Guidelines and Forest Plans and the preparation of regulations to guide development on forest lands.

Non-game species: Animal species which are not hunted, fished, or trapped.

NOx: Nitrogen oxides - A product of vehicle exhaust.

NPDES: National Pollution Discharge Elimination System - A program authorized by Sections 3.18, 402 and 405 of the Clean Water Act, and implemented by regulations 40 CFR 122. NPDES program requires permits for the discharge of pollutants from any point source into Waters of the United States.

NRHP: National Register of Historic Places.

NSPS: New Source Performance Standards - Standards set by EPA defining the allowable pollutant discharge (air and water) and applicable pollution control for new facilities; by industrial category. (Clean Air Act and Clean Water Act)

O

Objective: A concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals.

OSM: Office of Surface Mining Reclamation and Enforcement - An agency of the United States government within the Department of the Interior charged with regulating coal mining operations.

Overburden: Material of any nature that overlies a deposit of useful materials; waste earth and rock covering a coal or mineral deposit.

P

PAP: Permit application package.

Particulates: Small particles suspended in the air or generally considered pollutants.

Perennial stream: A stream that flows year-round.

Performance bond: See “reclamation guarantee.”

Permeability: The property or capacity of a porous rock, sediment, or soil for transmitting a fluid; it is a measure of the relative ease of fluid flow under unequal pressure.

Permit area: The area of land and water within the boundaries of the approved permit or permits during the entire life of the operation and includes all affected lands and waters.

pH: Symbol for the negative common logarithm of the hydrogen ion concentration (acidity) of a solution. The pH of 7 is considered neutral. A pH number below 7 indicates acidity, and a pH value above 7 indicates alkalinity or a base.

Piezometer: A device for measuring moderate groundwater pressure.

Piezometric surface: Any imaginary surface coinciding with the hydraulic pressure level of the water in a confined aquifer, or the surface representing the static head or groundwater and defined by the level to which water will rise in a well. A water table is a particular piezometric surface.

Planning records: The body of information documenting the National Environmental Policy Act decisions and activities which result form the process of developing environmental documents; also known as an administrative record.

Plant communities: A vegetation complex unique in its combination of plants which occurs in particular locations under particular influences. A plant community is a reflection of integrated environmental influences on the site such as soils, temperature, elevation, solar radiation, slope aspects, and precipitation.

PM_{10}: Particulates of 10 microns in size or less, usually describing a source of air quality degradation.

Point source: Stationary sources of potential pollutants. In terms of mining, some examples of point sources are crushing and screening equipment, conveyor transfer points, and pond outlets.

Policy: A guiding principle upon which is based a specific decision or set of decisions.

Pollution: Human-caused or natural alteration of the physical, biological and radiological integrity of water, air, or other aspects of the environment producing undesired effects.

Portal: An underground coal mining term. A horizontal or nearly horizontal access opening into a coal mine. Different from a tunnel which has both end opening to the surface.

Potable water: Suitable, safe, or prepared for drinking.

Potentiometric surface: Surface to which water in an aquifer would rise by hydrostatic pressure. (See "piezometric surface.)

ppm: Parts per million.

Precipitation event: A quantity of water resulting from drizzle, rain, snow, sleet, or hail in a limited period of time. It may be expressed in terms of recurrence, interval, and duration.

Prehistoric: Relating to the times just preceding the period of recorded history.

Production rate: The quantity of coal mined in a given time period.

Project: The whole of an action, which has a potential for resulting in a physical change in the environment. An organized effort to achieve an objective identified by location, timing, activities, outputs, effects, and time period and responsibilities for executions.

Proposed action: A description of the project as proposed by a project proponent in a plan of operations.

PSD: Prevention of Significant Deterioration - A specific permit procedure established in the Clean Air Act, as amended, used to ensure that economic growth occurs in a manner consistent with the protection of public health; preservation of air quality related values in national special interest areas; the opportunity for informed public participation in the decision-making process.

Public land: Lands administered by the Bureau of Land management, Forest Service, or other governmental agencies.

Public participation: Meetings, conferences, seminars, workshops, tours, written comments, responses to survey questionnaires, and similar activities designed and held to obtain comments from the public about planning.

Public scoping: Giving the public the opportunity for oral or written comments concerning the intentions, activity, or influence of a project on an individual, the community, and/or the environment.

Q

R

Raptor: Bird of prey, including eagles, hawks, falcons, and owls.

Reclamation: Returning disturbed land to a productive form, usually in conformity with a predetermined Land Management Plan or a government approved plan or permit.

Reclamation guarantee: A binding commitment payable to a government agency in the event that decommissioning and reclamation of an operation is not completed according to an approved plan or permit. See "bond."

Reclamation Plan: A document that details the measures to be taken by a project proponent (permit holder) to reclaim the project lands; such a document can contain reclamation measures to be employed during mining operations but typically describes measures to be used after mining and milling have been completed.

REDP: Regional Economic Design Project.

Resident: A species, which is found in a particular habitat for a particular time period (i.e., winter resident, summer resident, year-round) as opposed to those found only when passing through on migration.

RFDS: Reasonably foreseeable development scenarios.

Riparian: A type of ecological community that occurs adjacent to streams and rivers and is directly influenced by water. It is characterized by certain types of vegetation, soils, hydrology, and fauna and requires free or unbound water or conditions more moist than that normally found in the area.

Riparian zone: Terrestrial areas where the vegetation and microclimate are influenced by perennial and/or intermittent water, associated high water tables and soils which exhibit some wetness characteristics; this habitat is transitional between true bottom land wetlands and upland terrestrial habitats.

RMP: Resource Management Plan.

ROD: Record of Decision - A document separate from, but associated with, an Environmental Impact Statement which states the decision, identifies alternatives, specifying which were environmentally preferable, and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and if not, why not (40 CFR 1505.2).

Room-and-Pillar Mining: A mining system that uses a continuous miner to excavate coal (rooms) leaving a rectangular pattern of coal (pillars) as roof support in the mine.

Runoff: precipitation that is not retained on the site where it falls, not absorbed by the soil; natural drainage away from an area.

S

Safety factor: A safety factor is a ratio of resisting forces to driving forces. By determining a structure's safety factor, a numerical index of stability is obtained.

Scoping process: A part of the National Environmental Policy Act process; early and open activities used to determine the scope and significance of the issues, and the range of actions, alternatives, and impacts to be considered in an Environmental Impact Statement (40 CFR 1501.7).

Sediment: Each material transported, suspended, or deposited by water, also, the same material once it has been deposited.

Sedimentation pond: A sediment control structure designed, constructed, and maintained to slow down or impound precipitation runoff to reduce sediment concentrations in a point source discharge, including dams or excavated depressions. The term does not include straw dikes, riprap, check dams, mulches, collection ditches, toe ditches, vegetative buffers, gabions, contour furrows, and other traditional soil conservation techniques and non-point source runoff controls.

Sensitive species: Plant or animal species which are susceptible or vulnerable to activity impacts or habitat alterations. Those species that have appeared in the Federal Register as proposed for classification or are under consideration for official listing as endangered or threatened species, that are on an official state list, or that are recognized by the regional Forester as needing special management to prevent placement on federal or state lists.

Shaft: An underground coal mining term. A vertical or inclined passageway which connects two or more levels in a mine.

SHPO: State historic Preservation Office.

Short-term impacts: Impacts occurring during project construction and operation, and normally ceasing upon project closure and reclamation. Each resource, by necessity, may vary in its definition of short-term.

Significant: Requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts. The severity of an impact should be weighted along with the likelihood of its occurrence.

SMCRA: Surface Mining Control and Reclamation Act.

SO_2: Sulfur oxides, including sulfur dioxide (SO_2). A product of vehicle tailpipe emissions.

Socioeconomic: Pertaining to, or signifying the combination or interaction of social and economic factors.

Soil horizon: A layer of soil material approximately parallel to the land surface differing from adjacent genetically related layers in physical, chemical, and biological properties.

Solid waste: Garbage, refuse, and/or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, agricultural, and community activities.

Sound level (dBA): The sound pressure level in decibels as measured on a sound level meter using the A-weighing filter network. The A-weighing filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the responses of the human ear and gives good correlation with subjective reactions to noise.

SPCC: Spill Prevention Control and Countermeasure Plan - A plan which the EPA requires having on file within six months of project inception. It is a contingency plan for avoidance of, containment of, and response to hazardous materials spills or leaks.

Standard: A model, example, or goal established by authority, custom, or general consent as a rule for the measurement of quantity, weight, extent, value or quality.

Stream gradient: The rate of fall or loss of elevation over the physical length of a segment or total stream usually expressed in ft/ft (%).

Subsidence: A lowering of surface land caused by the collapse of rock and soil into an underground void.

Substantive comment: A comment that provides factual information, professional opinion, or informed judgement germane to the action being proposed.

T

TDS: Total Dissolved Solids - Any finely divided materials (with a diameter smaller than a few hundred micrometers) suspended in liquids such as water.

Terrestrial: Of or relating to the earth, soil, or land; an inhabitant of the earth or land.

Threatened species: Those plants or animal species likely to become endangered species throughout all or a significant portion of their range within the foreseeable future.

Third-party contractor: An independent firm, usually contracted by a government agency, to perform

work related to a proposed action or another organization; due to the financial and contractual arrangements governing such relationships, the third-party contractor has no financial or other interest in the decision to be reached on the project.

Topography: A configuration of a surface including its relief, elevation, and the portion of its natural and human-created features.

tpd: Tons per day.

TPH: Total petroleum hydrocarbons.

TSP: Total Suspended Particulates - Any finely divided material (solid or liquid) that is airborne with an aerodynamic diameter smaller than a few hundred micrometers.

TSS: Total Suspended Solids - As it applies to sediments in streams.

Turbidity: Reduced water clarity resulting from the presence of suspended matter.

U

Unavoidable effects: Many effects which could occur from a project can be eliminated or minimized by management requirements and constraints and mitigation measures. Effects that cannot be eliminated are identified as unavoidable.

Underground coal mine: A subterranean excavation made for the purpose of extracting mineable coal.

USDA: United States Department of Agriculture.

USDI: United States Department of the Interior.

USFWS: United States Fish and Wildlife Service - United States Department of the Interior.

USGS: United States Geological Survey - United States Department of the Interior.

Understory: A foliage layer lying beneath and shaded by the main canopy of a forest.

V

W

Watershed: The entire land area that contributes water to a particular drainage system or stream.

Water quality: The interaction between various parameters that determines the usability or non-usability of water for on-site and downstream uses. Major parameters that affect water quality include: temperature, turbidity, suspended sediment, conductivity, dissolved oxygen, pH, specific ions, discharge, and fecal coliform.

Weathering: The process whereby larger particles of soils and rock are reduced to finer particles by wind, water, temperature changes, and plant and bacteria action.

Wetlands (Biological Wetlands): Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, etc. (See "jurisdictional wetlands.")

Wilderness: Land designated by Congress as a component of the National Wilderness Preservation System.

Wind rose: A diagram showing the relative frequency of winds blowing from different directions.

WRIS: Wildlife Resource Information System.

X

Y

Z

10-year, 24-hour event: The precipitation that is predicted to occur during a 24-hour period with a 10-year recurrence interval.

25-year, 24-hour event: The precipitation that is predicted to occur during a 24-hour period with a 25-year recurrence interval.

404 Permit: Section 404 of the Clean Water Act specifies that anyone wishing to place dredge or fill materials into the Waters of the united States and adjacent jurisdictional wetlands shall apply to the U.S. Army Corps of Engineers for approval. A permit issued by the Corps of Engineers for these activities is known as a 404 permit.

Chapter 8

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LIST OF APPENDICES

Appendix A

Lease Tract Information

ALTERNATIVE B

In August of 1997, Bowie Resources, Ltd.(Bowie) filed coal lease application COC-61209 (Iron Point Tract) requesting the Bureau of Land Management (BLM) offer federal coal for competitive lease. The application was for the following lands:

T12S, R91W, 6th PM:
  Section 33, lots 1 to 16, inclusive, S½ N½;
  Section 34, lots 1 to 16, inclusive, S½ N½;
T13S, R91W, 6th PM
  Section 2, SW¼ NW¼, NW¼ SW¼, and E½ SW¼;
  Section 3, lots 1 to 4, inclusive, S½ N½, and N½ S½;
  Section 4, lots 1 to 4, inclusive, S½ N½, and S½;
  Section 5, S½ SE¼, and SE¼ SW¼;
  Section 8, NE¼;
  Section 9, NW¼, and N½ SW¼;
  Section 11, NE¼ NW¼.

Containing approximately 3,403.27 acres±, with an estimated 24 million tons of recoverable coal or 7,050 tons per acre. The coal resource within the Iron Point Tract is limited to coal recoverable by underground mining methods.

In December of 1997, Oxbow Mining Inc. filed coal lease application COC-61357 (Elk Creek Tract), requesting the BLM offer for competitive lease federal coal in the lands described as:

T12S, R90W, 6th PM:
  Section 31, lots 1 to 14, inclusive, and NE¼;
  Section 32, lots 3 to 6, inclusive, lots 11 to 14, inclusive, and NW¼.
T12S, R91W, 6th PM:
  Section 35, lots 1, 2, and 4 to 8, inclusive, 13 to 16, inclusive, lots 21, 22, and that part of HES No. 134 lying in the NE¼;
  Section 36, lots 1 to 17, inclusive, NE¼, E½ NW¼, SW¼ NW¼, and that part of HES No. 134 lying in lot 1.
T13S, R90W, 6th PM:
  Section 5, lots 6* to 11*, inclusive, and lot 15;
  Section 6, lots 8 to 17, inclusive.
T13S, R91W, 6th PM:
  Section 1, lots 1 to 4, inclusive, S½ NW¼ and SW¼;
  Section 2, lot 1, and S½ NE¼;
  Section 12, S½ NE¼, and NW¼.

Containing approximately 3,292 acres±, with approximately 21 million tons of recoverable coal or 5,436 tons per acre. The coal resource to be offered for lease is limited to coal recoverable by underground mining methods.

* At the time of publication, lots 6 and 11 were being replatted. Final descriptions and acreages may vary accordingly.

In May of 1998, Bowie filed a coal exploration license application (COC-61945), with the BLM. The Iron Point Exploration License contains unleased coal deposits owned by the United States of America in the following described lands in Delta County, Colorado.

T12S, R91W, 6th PM:
Section 14, lots 7, 8, S½ S½, NE¼ SW¼, NW¼ SE¼;
Section 22, S½;
Section 23, lots 1 to 7, inclusive, W½, and that part of HES No. 133 lying in the S½ SE¼;
Section 26, lots 1 to 5, inclusive, W½, N1/2SE¼, and that part of HES No. 133 lying in the NE¼;
Section 27, all;
Section 28, S½;
Section 29, SE¼;
Section 32, lots 1, 2, 7 to 10, inclusive, lots 15, 16, and NE¼;
Section 33, lots 1 to 16, inclusive, and N½;
Section 34, lots 1 to 16, inclusive, and N½;
Section 35, lots 3, and 7 to 22, inclusive, NE¼ NW¼, W½ NW¼, that part of HES No. 134 and that part of lots 4 to 6, inclusive, lying in the S½ S½ NE¼.

Containing approximately 6,053.00 acres±.

These applications encompass federal coal on BLM and Gunnison National Forest lands. Additions and/or deletions to the delineated tracts may be considered as alternatives to Alternative B. Alternatives would be developed and analyzed based on issues and management needs.

ALTERNATIVE C

Add to the Iron Point Tract the following description:

T13S, R91W, 6th PM
Section 5, lots 11, 12, SW¼ NE¼, SE¼ NW¼, NE¼ SW¼, N½ SE¼ containing approximately 240 acres. It is estimated that there are 11,750 tons of recoverable coal per acre (42.8 million tons).

Add to the Elk Creek Tract the following description:

T12S, R91W, 6th PM:
Section 35, lots 3, 9 to 12, inclusive, lots 17 to 20, inclusive, N½ NW¼, and SW¼ NW¼.

Containing approximately 433.78 acres. It is estimated that there are 5,375 tons of recoverable coal per acre (23.1 million tons).

ALTERNATIVE D

The acreage for both the Iron Point and Elk Creek tracts remains the same as Alternative C. It is estimated that there are 11,225 tons of recoverable coal per acre (40.9 million tons) on the Iron Point Tract and 5,375 tons of recoverable coal per acre (23.1 million tons) on the Elk Creek Tract.

SURFACE OWNERSHIP

The surface ownership of the lands is shown on *Figure 2, Surface Ownership Map*. All the acreage described above contains federally managed minerals. Approximately 1,714 acres are privately owned surface, 6,842 acres are managed by the Forest Service, and 3,155 acres are managed by the BLM.

Appendix B

Agency Jurisdiction (Permits and Approvals)

TABLE OF CONTENTS

LIST OF TABLES

A number of federal, state, and local permits and approvals are or could be required for the exploration and mining of the Iron Point and Elk Creek Coal Lease tracts. See *Table B-1, List of Permits and Approvals*. Many of the listed permits are required at the mine permit stage not the leasing stage. They are included here to give the reader a more complete picture of the coal permitting process.

Preparation of an Environmental Impact Statement (EIS) and the actual permitting processes are related but distinctively separate. An EIS is designed to explore alternatives and discuss environmental impacts. The permitting or approval processes give individual government decision-makers the authority to grant, conditionally grant, or deny individual permit applications. Permits may be granted with requirements and conditions to eliminate and/or mitigate specific adverse impacts pursuant to their individual regulations and guidelines.

1.0 BUREAU OF LAND MANAGEMENT

For the North Fork Coal EIS, the Bureau of Land Management (BLM) is serving as a joint lead agency in the EIS process with the Forest Service. The BLM will follow a specific procedure that began with scoping and data collection which will result in the assessment and analysis of alternatives. The results of the environmental analyses are documented in the EIS and will form the basis for the Colorado State Director of the BLM in making a decision on leasing and exploration.

The BLM responsibilities include the following:

- Competitive coal leasing;
- Resource recovery and protection plans; and,
- Special use permits.

1.1 Competitive Coal Leasing

In response to the competitive coal lease applications, or LBAs, submitted by Bowie Resources Ltd. (Bowie) for the Iron Point Coal Lease Tract (COC-61209) and by Oxbow Mining for the Elk Creek Coal Lease Tract (COC-61385), the BLM will process these coal lease applications in accordance with the regulations found at 43 CFR 3420. In conjunction with the Forest Service, the BLM will prepare an EIS to analyze potential impacts of the proposed leasing and reasonably foreseeable mining actions, as well as develop mitigating measures to be included as lease stipulations in the event a competitive sale is held.

The BLM will conduct a public hearing before a competitive sale is held to allow public comment on the effects of mining on the proposed lease. The BLM must also evaluate lease proposals with respect to coal unsuitability criteria developed by the Department of the Interior. This evaluation has been completed in conjunction with the BLM-Uncompahgre Basin Resource Management Plan (1989) and the Forest Service Land and Resource Management Plan for the Grand Mesa, Uncompahgre and Gunnison National Forests, as amended (September 1991). The criteria has also been reviewed for implications with the other alternatives in this analysis. In addition, data adequacy standards were reviewed and determined to be adequate.

Table B-1
List of Permits and Approvals

Federal Government	*	
Bureau of Land Management	1L 1P 1P 2P 1L	▸ Lease Issuance and Administration ▸ Mine Permit Concurrence ▸ Resource Recovery and Protection Plans (R2P2) Approval ▸ Special Use Permits (right-of-ways, etc.) ▸ Approve Exploration License
Forest Service	1L 1P 2P 1L	▸ Consent to Lease ▸ Mine Permit Consent/Concurrence ▸ Special Use Permits (road use) ▸ Consent and Prescribe Use for Exploration License
Office of Surface Mining	2P	▸ Mining Plan Document Preparation (Mineral Leasing Act)
U.S. Department of the Interior	2P	▸ Mining Plan Approval (Mineral Leasing Act
U.S. Army Corps of Engineers	P	▸ Section 404 Permit
Environmental Protection Agency	1P P O	▸ Spill Prevention Control and Countermeasure (SPCC) Plan ▸ Review of Section 404 Permit ▸ Notification of Hazardous Waste Activity
U.S. Fish and Wildlife Service	1L	▸ Threatened and Endangered Species Consultation
Treasury Department (Department of Alcohol, Tobacco, and Firearms)	P	▸ Explosives User Permit
Mine Safety and Health Administration	O O O O O	▸ Mine Identification Number ▸ Legal Identify Report ▸ Miner Training Plan Approval ▸ Ventilation Plan Approval ▸ Ground Control Plan
State of Colorado		
Colorado Department of Minerals and Geology	1P 1P	▸ Exploration Permit ▸ Mining and Reclamation Permit
Colorado Air Pollution Control Division	P 1P	▸ Permit to Construct ▸ Permit to Operate
Colorado Water Quality Control Division	1P 1P	▸ Storm Water Discharge Permit ▸ National Pollutant Discharge Elimination System (NPDES)
Colorado State Engineer	1P P P	▸ Water Rights ▸ Water Well Permits ▸ Dam Safety Permits
Colorado State Historic Preservation Office	1L/P	▸ Historic and Archaeological Review
Colorado Department of Transportation	P	▸ Highway Access
Local Government		
Delta County	O	▸ Building Permit
Gunnison County	O/P O	▸ Land Use Change Permit ▸ Building Permit

* Sequence of permits/approvals for federal coal resource development. L = Leasing, P = Permitting, O = Operations Leasing is followed by permitting which is followed by operations. Numbers indicate the steps in each sequence in order of occurrence. Where no number indicator exists, it means that the activity is continuous throughout the step or procedure.

Following the completion of the EIS, the Montrose District Office of the BLM will forward the competitive lease application, the North Fork Coal EIS, a Maximum Economic Recovery report (MER), a proposed Record of Decision, proposed lease terms and conditions, and preliminary recommendations for each lease tract to the Colorado State Director of the BLM in Denver. The Colorado State Director will make a determination on leasing action, the proposed lease terms and conditions, and the bonding requirements. The Colorado State Director will then prepare newspaper and Federal Register notices of the sale and post such notices of the proposed sales in the Public Room at the state office of the BLM. A sales panel consisting of the Deputy State Director for Mineral Resources, a BLM mining engineer, a BLM geologist, and a BLM mineral economist will then be designated as the group that will analyze prospective bidders and make recommendations regarding bids received at the proposed lease sale.

1.2 Exploration License

An exploration license is processed in much the same way as a lease application. The BLM will process Bowie's Iron Point Exploration License application, COC-61945 in accordance with the regulations in 43 CFR 3400. In conjunction with the Forest Service, the BLM will use this EIS to analyze potential impacts and develop mitigating measures to be included as stipulations in the event a license is issued.

Following the completion of the EIS, the Uncompahgre Field Office of the BLM will forward preliminary recommendations and any proposed terms and conditions to the Colorado State Director in Denver. The Colorado State Director will then make a determination, consistent with the Forest Service's recommendations under the consent provisions (see Section 2.0, Forest Service), on the issuance of the exploration license.

1.3 Resource Recovery and Protection Plans (R2P2)

If a lease is issued, prior to any lease development, the lessee or operator must file a Resource Recovery and Protection Plan (R2P2) with the BLM to comply with 43 CFR 3482. This plan contains detailed information regarding the coal seams within the lease boundaries and requires the lessee and/or the operator to submit detailed mining plans regarding the coal to be mined. It is the responsibility of the BLM to ensure that the coal resources within the lease will be appropriately mined such that maximum coal recovery can be achieved. The purpose of the R2P2 is to ensure that the federal government receives the maximum royalties from the resource within the lease boundaries, and that the recovery of the coal resource is accomplished so as to minimize the loss of any coal resource for future extraction.

1.4 Special Use Permits

On public lands administered by the BLM, the agency has review and approval authority for any project related right-of-ways such as access roads. The BLM will be responsible for issuing special use permits for these type of activities.

2.0 FOREST SERVICE JURISDICTION

For the North Fork Coal EIS, the Forest Service is serving as a joint lead agency in the EIS process with the BLM. With this responsibility, the Forest Service will work with the BLM throughout the EIS process.

The Forest Service was granted consent authority with regard to the issuance of coal leases and licenses with the passage of the Federal Coal Leasing Amendment Act of 1976. Under this act, a coal lease or license may not be issued without consent of the surface managing agency, (i.e., the Forest

Service in the case of the Iron Point and Elk Creek Coal Lease Tracts), and not without including conditions (stipulations) upon which consent is given. Under 43 CFR 3420.4-2(a) it is stated:

> *The Secretary of the Interior, for any proposed lease tract containing lands the surface of which is under the jurisdiction of any agency other than the department (of the interior), shall request that that agency: (1) consent, if it has not already done so, to the issuance of the lease (43 CFR 3400.3-1), and (2) if it consents, prescribe the terms and conditions the Secretary will impose in any lease which the head of the agency requires for the use and protection of non-mineral interests in those lands.*

Under the Forest Service Manual Chapter 2820, R2 supplement No. 2800-94-1, 2822.04(c), the Regional Forester of the Rocky Mountain Region has delegated the authority to sign all decision documents for mineral leases (consent to leases) to the Forest Supervisor. In the case of the North Fork Coal EIS, the Forest Supervisor of the Grand Mesa, Uncompahgre, and Gunnison National Forests will be the responsible official for any decisions regarding the Iron Point Coal Lease Tract, the Elk Creek Coal Lease Tract, and the exploration license area within and surrounding the Iron Point Tract.

Regarding any specific ground disturbing activities on forest lands, the Forest Service is responsible for the oversight of such activities, and the agency may require a reclamation performance security (i.e., reclamation bond), prior to allowing any ground disturbing activities on forest lands.

Similar to the BLM, on any public lands administered by the Forest Service, the agency has review and approval authority for any project related right-of-ways, access roads, dam or dike construction, etc. In these instances, the Forest Service would require a Special Use Permit from the lessee or the operator on Forest Service administered lands.

3.0 OFFICE OF SURFACE MINING JURISDICTIONS

The OSM is a cooperating agency with the BLM and the Forest Service on the North Fork Coal EIS. As such, OSM has provided input into the North Fork Coal EIS process.

The Surface Mining Control and Reclamation Act (SMCRA), gives OSM primary responsibility to administer programs that regulate surface coal mining operations on federal lands and the surface effects of underground coal mining operations on federal lands.

Pursuant to Section 503 of SMCRA, the Colorado Division of Mining and Geology (DMG) developed, and the Secretary of the Department of the Interior approved, a permanent program authorizing the Colorado DMG to regulate surface coal mining operations and surface effects of underground coal mining on non-federal lands within the state of Colorado. In September of 1982, pursuant to Section 523(c) of SMCRA, the Colorado DMG entered into a cooperative agreement with the Secretary of the Department of the Interior authorizing the Colorado DMG to regulate surface coal mining operations and the surface effects of underground mining on federal lands within the state of Colorado.

Pursuant to that cooperative agreement, federal coal lease holders in Colorado must submit permit applications to both the OSM and the Colorado DMG for proposed mining and reclamation operations on lands in the state of Colorado. The Colorado DMG will review the permit application packages to ensure that the permit application complies with their permitting requirements and that the coal mining operation will meet the approved permanent regulatory program's performance standards. If the permit application package complies with the applicable regulations and performance standards, the Colorado DMG will issue the lessee or operator a permit to conduct coal mining and reclamation operations on the subject lease.

The public has the opportunity to provide comments to the Colorado DMG and request an informal conference or a public hearing on each permit application package. These opportunities for comment are published as legal notices in a local newspaper of general circulation.

The OSM, Forest Service, BLM, and other appropriate federal agencies will review the permit application package to ensure that it complies with the terms of the coal lease, the requirements of the Mineral Leasing Act of 1920 ("MLA"), the National Environmental Policy Act of 1969 ("NEPA"), and other federal laws and their attendant regulations.

The OSM will recommend approval, approval with conditions, or disapproval of any MLA mining and reclamation plan involving federal coal to the Assistant Secretary of the Department of the Interior - Lands and Minerals Management. Before the mining plan can be approved, the BLM, Forest Service and a surface-managing agency, if other than the BLM or Forest Service, must concur with this recommendation.

The Colorado DMG enforces the performance standards and permit requirements during the operation of the mine and have primary authority in environmental emergencies. The OSM retains oversight responsibility for this enforcement. The BLM has authority in those emergency situations where the Colorado DMG or OSM inspectors can not act before environmental harm or damage occurs.

The information and data submitted in the coal lease applications by Bowie and Oxbow do not constitute a formal underground mining permit application package to either the OSM or the Colorado DMG. This coal lease application information has been used solely to develop an impact analysis in the EIS. Its use is intended to illustrate one possible plan for developing federal coal reserves on the lease tracts and does not imply that either Bowie or Oxbow would be given any preference in the event that lease sales are held. In addition, such information does not imply that the permit application package developed from these preliminary plans would comply with the regulations or be approved by the Colorado DMG if a lease sale were held and Bowie or Oxbow obtained the respective lease tracts for which they are applying. Any plan which is ultimately submitted must comply with the regulations of the Colorado DMG and the OSM before such plan can be approved.

4.0 MINERALS MANAGEMENT SERVICE

The Minerals Management Service has no permitting responsibilities associated with coal mining. However, this organization is an important government agency with its primary function focused at collecting royalties from the mining of coal on federal lands. The Mineral Management Service regularly works with the BLM regarding mining on federal coal lease tracts and reviews mine maps and other documentation in order to assess the coal tonnages extracted from the federal coal lease. In addition, the Mineral Management Service will review coal sales records of the lessee or operator to ensure that the federal government receives the appropriate royalty amount from the extracted federal coal. For surface mines, the royalty for federal coal is 12.5 percent of the sales price of the coal at the mine site; for underground coal mining operations the royalty is 8 percent of the sales price at the mine site.

5.0 U.S. ARMY CORPS OF ENGINEERS

The Corps of Engineers is responsible for issuing permits under Section 404 of the Clean Water Act which requires permits for the "discharge of dredged or fill material into navigable waters." Guidelines promulgated by the Environmental Protection Agency (EPA) under Section 404(b)(1) generally prohibit the discharge of dredged or fill materials into "Waters of the United States" unless it can be shown that the discharge is the least environmentally damaging practicable alternative to achieve the basic purpose of the proposed project.

The term "Waters of the United States" is broadly defined as waters that are or could be used in interstate or foreign commerce. In addition to territorial seas and interstate waters, this includes other waters such as lakes, mud flats, sloughs, and wetlands which are or could be used in interstate or foreign commerce. To the degree that they impact "Waters of the United States," various activities associated with mining operations, such as road or bridge construction, mine portal site development and construction, construction of water storage dams, etc., may require a Section 404 Permit.

The Corps of Engineers must comply with Executive Orders 11990 and 11998 with respect to impacts to the nations wetlands and/or floodplains. The "no net loss" wetlands policy is outlined in an agreement between Corps of Engineers and the EPA. The policy goal of the no net loss to wetland acreage or function is implemented primarily through permit review.

In reviewing Section 404 permit applications, the Corps of Engineers must evaluate whether the benefits from the project outweigh the predicted environmental impacts. This is called a "public interest review." Factors considered during the public interest review include the following:

- Basic project purpose and need;
- Water dependency;
- Availability of practicable alternatives, taking into consideration cost, logistics, and technology; and,
- Environmental impacts.

The Corps of Engineers evaluates whether the proposal is the least environmentally damaging practicable alternative. It may be necessary for the applicant to include mitigation measures that will reduce impacts to the aquatic environment to an acceptable level. These measures may include avoiding fills to "Waters of the United States", reducing the area of fill, creating or restoring aquatic environments, and/or enhancing the value of an existing aquatic area.

6.0 ENVIRONMENTAL PROTECTION AGENCY

NEPA documents, such as the Draft EIS, the Final EIS, and Records of Decision completed by the BLM and Forest Service for the lease tracts regarding the North Fork Coal EIS, will be filed with the EPA.

In addition to its NEPA oversight responsibilities, the EPA has responsibilities involved with the following:

- Clean Water Act; and
- Clean Air Act.

6.1 Clean Water Act

The Clean Water Act has established the following surface water programs which may concern mining operations of either Bowie or Oxbow in the Iron Point and Elk Creek Coal Lease Tracts:

- The NPDES permit program regulating the point source and storm water discharge of pollutants;

- The Section 404 permit program regulating the discharge of dredged or fill material; and,

- The Section 311 program regulating spills of oil and hazardous substances.

EPA established the National Pollutant Discharge Elimination System (NPDES) program for regulating surface water quality. This program was principally established by the Federal Water Pollution Control Act Amendments of 1972 and supplement amendments and re-authorization. In its amended and re-authorized form, this statute as a whole is now generally referred to as the Clean Water Act.

The NPDES permit program is established by Section 402 of the Clean Water Act. The Colorado Department of Public Health and Environment is the permitting authority in the state of Colorado for the issuance of NPDES permits pursuant to Section 402 of the Clean Water Act.

Section 404 of the Clean Water Act authorizes the Corps of Engineers to issue permits "for the discharge of dredged or fill materials into navigable waters." These permits are addressed under 14.5, U.S. Army Corps of Engineers Responsibilities, which immediately precedes this discussion. The EPA is responsible for reviewing the consistency of any proposed 404 action with Section 404(b)(1) guidelines.

Section 311 of the Clean Water Act establishes requirements relating to discharges or spills of oil or hazardous substances. Discharges or spills of oil in "harmful quantities" are prohibited. The EPA has established a requirement for the preparation of a Spill Prevention Control and Countermeasure (SPCC) plan by facilities that handle substantial quantities of oil.

6.2 Clean Air Act

In addition to water quality oversight, the EPA also maintains control over the air resources of an area as outlined in the Clean Air Act. The Clean Air Act's most basic goals are to protect public health and welfare. The EPA can comment on, but is not responsible for, a new source (air quality) construction permit issued by the Colorado Department of Public Health and Environment.

7.0 U.S. FISH AND WILDLIFE SERVICE

The U.S. Fish and Wildlife Service administers the Endangered Species Act, as re-enacted in 1982, and the Bald Eagle Protection Act of 1940, as amended. On the North Fork Coal EIS, the BLM and Forest Service consulted with the U.S. Fish and Wildlife Service regarding any federally listed threatened or endangered species that might be impacted by proposed operations. This is known as the Section 7 Consultation. A biological assessment has been prepared by the BLM and Forest Service for any federally listed threatened or endangered species, and this document has been submitted to the U.S. Fish and Wildlife Service. If adverse impacts to threatened or endangered species are projected, specific design measures to protect the affected species may need to be developed.

8.0 U.S. MINE SAFETY AND HEALTH ADMINISTRATION

The health and safety aspects of Bowie and Oxbow operations are regulated by federal health and safety standards for mining operations. The Mine Safety and Health Administration (MSHA) makes comprehensive routine inspections of the underground coal mining operations and are involved in educational and safety training programs for company personnel. Underground coal mining operators are also responsible for providing MSHA with reports of accidents, injuries, occupational diseases and related data. Specific programs for the education and training of all underground coal mining employees are also a part of the health and safety regulations of MSHA. MSHA also reviews and approves ventilation plans and ground control plans for underground coal mines.

9.0 TREASURY DEPARTMENT (DEPARTMENT OF ALCOHOL, TOBACCO AND FIREARMS)

Intrerstate transportation of explosives is regulated by the Department of Alcohol, Tobacco and Firearms. Underground coal mining operators or their explosives suppliers will need to obtain a license for transport of such explosives to the site. In addition, an explosive user permit will also be required by this agency.

10.0 ADVISORY COUNCIL ON HISTORIC PRESERVATION

A copy of both the Draft EIS and Final EIS documents must be filed with the Advisory Council on Historic Preservation. This agency works in an advisory role to assist the BLM and Forest Service with compliance with the National Historic Preservation Act and the American Indian Religious Freedom Act. In addition, the Colorado State Historic Preservation Office will give concurrence with any agency determined cultural impacts. The Advisory Council on Historic Preservation would be available to serve in an advisory role if requested by the Colorado agency. The Advisory Council on Historic Preservation may also review state program activities and determine relative compliance to the previously mentioned National Historic Preservation Act.

11.0 COLORADO DEPARTMENT OF MINERALS AND GEOLOGY

Under the Colorado Surface Coal Mining Reclamation Act (34-33-101 et. seq., CRS 1973, as amended) and the regulations of the Coal Mined Land Reclamation Board for coal mining (1980, amended), the Colorado DMG requires a permit to regulate surface coal mining activities and the surface effects of underground coal mining. The purpose of this permitting program is to ensure the disturbed areas are reclaimed and environmental protection is ensured for coal mining activities within the state of Colorado. Performance security for reclamation activities is required before this permit is granted.

The Colorado DMG requires engineering information for coal mining operations including topographic maps, sequence of mining, coal waste disposal sites, borrow sites, construction methods, equipment to be used, plans for mitigation of runoff and erosion, sediment control measures, and the proposed methods and schedule of reclamation. Environmental information includes soil characterization and topsoil management, erosion control measures, reclamation and revegetation plans and methods to protect ground and surface water quality.

In addition, the Colorado DMG has permitting requirements for coal exploration activities. Such permitting activities require a description of the planned exploration, the methods and schedule for reclamation and environmental protection measures to be employed during exploration.

12.0 COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT AIR POLLUTION CONTROL DIVISION

The Colorado Department of Public Health and Environment - Air Pollution Control Division has review and approval authority over new source construction or additions or modifications to existing sources for releasing contaminants into the air. The Air Pollution Control Division has regulatory responsibility for the following permits which may affect mining operations:

- Permit to Construct;
- Permit to Operate; and,
- Prevention of Significant Deterioration.

12.1 Permit to Construct

This permit requires the applicant to submit an emissions inventory listing sources and amounts of air pollution released, an analysis of best available control technology (BACT), and a demonstration that ambient air quality standards, including levels for toxic air pollutants will not be exceeded. The statutory authority for new source construction approval is the Colorado Clean Air Act and subsequent regulations.

12.2 Permit to Operate

The Colorado Air Pollution Control Division has a comprehensive air operating permit program which is consistent with the requirements of Title V of the Federal Clean Air Act. Facilities will be required to obtain operating permits within six months of the issuance of initiation of construction activities.

12.3 Prevention of Significant Deterioration

The basic objective of the prevention of significant deterioration (PSD) air quality program is to prevent substantial degradation of air quality in areas that are in compliance with national ambient air quality standards, while maintaining a margin for future growth. As part of the new source review, PSD applicability is determined.

Criteria that trigger the requirements for a PSD permit vary depending on the type of facility. In the case of mining, a PSD permit is not required for operations that emit less than 250 tons per year of any pollutant regulated under the Federal Clean Air Act. Pollutants can include both particulate (dust) and gaseous SO_2, CO_2, NO_x and HC emissions.

Specific information on PSD requirements can be found in 40 CFR 52.221 as adopted. If a PSD permit is required, one year of site-specific ambient air quality data collected by the applicant is typically needed.

13.0 COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT - WATER QUALITY CONTROL DIVISION

Under authority delegated by the EPA, the Colorado Department of Public Health and Environment - Water Quality Control Division regulates the discharge of pollutants into Colorado's surface waters through the NPDES permit (see Section 14.6.1, Clean Water Act, of this document).

An application for an individual NPDES permit requires information on water supply volumes, water utilization, waste water flow characteristics and disposal methods, planned improvements, storm water treatment, plant operation, materials and chemical used, production, and other related information. Depending on the type of materials to be mined, the EPA regulations may specify effluent limitations for inclusion in an NPDES permit for the discharge of waste waters and storm water. Mines for which EPA has not promulgated storm water effluent limits are required to obtain coverage under a general storm water permit issued by the Colorado Water Quality Control Division. Processing time for an individual NPDES permit ranges from about 180 days to 1 year, but varies upon project complexity. A public hearing on a proposed NPDES permit may be required.

14.0 COLORADO STATE ENGINEER'S OFFICE

The Colorado State Engineer has oversight responsibility for the following permits:

- Dam Safety Permit; and,
- Permit to Appropriate Public Waters.

14.1 Dam Safety Permit

The Colorado State Engineer requires approval for any person or entity intending to construct, modify, or repair any dam or control works for a dam or dike that will store water to a depth of 10 or more feet at its deepest point or a dam or dike that will contain 10 or more acre-feet of water. Reservoir applications require information on the use and capacity of the reservoir and a legal description of the location of the structure.

Before beginning any construction, plans and specifications must be prepared by a properly qualified Colorado state Certified Professional Engineer (carrying the engineer's signature and seal) and submitted for approval to the Colorado State Engineer. Plan approval is required before beginning construction.

The Colorado State Engineer's office is also required to periodically inspect the construction and operation of any dams in order to secure safety to life and property.

14.2 Permit to Appropriate Public Waters

Authority to use public water is granted through issuance of a permit to appropriate public waters from the Colorado State Engineer's office.

A permit is required prior to the development of any diversion of surface water and/or withdrawal of groundwater.

A public notice is required prior to obtaining a permit to appropriate public waters. A 30-day comment period is provided after public notice. The Colorado State Engineer evaluates the application and any objections which were filed in response to the public notice with particular attention to the following questions:

- Is water available to satisfy the applicants needs?
- Would the appropriation of water impair the senior rights or injure the instream values of the water source?
- Does the applicant propose a beneficial use of water?
- Would the appropriation be detrimental to the public interest?

Permits may be issued which may authorize water use for a limited period of time (a temporary permit). In addition, changes to existing water rights must be reviewed and approved (i.e., point of withdrawal, changes in use, etc.).

Any permit issued must be specific as to the following:

- Water quantities to be appropriated, instantaneous and annual;
- The period of use;
- The point from which the water may be obtained;
- The purpose for which the water may be used; and,
- The place of use.

Provisions and limitations specific to the proposed water use and a development schedule for completing the project are normally associated with the permit. A permit only authorizes development of a project and does not represent the extent of a final water right. To the extent that water is beneficially used within the limitations of a "regular" permit, a certificate of a water right may be issued documenting a perfected water right. The processing time of a water right varies but can take up to 18 months. Public notice is required for water right applications.

15.0 COLORADO STATE HISTORIC PRESERVATION OFFICE

The Colorado State Historic Preservation Office must be contacted prior to the start of a project to determine if historic and archaeological sites will be affected. The status of any sites or structures listed in or eligible for National Register of Historic Places or local landmark designation will need to be determined. Plans for protection or mitigation measures may be a condition of concurrence with agency determined cultural impacts.

The Colorado State Historic Preservation Office also must be consulted when projects are subject to review under Section 106 of the National Historic Preservation Act of 1966. This act requires that all federal agencies take into account the effect of their actions on historic properties. The Colorado State Historic Preservation Office should be consulted to determine if the site has been surveyed, if there are identified historic resources on site, and if the property is listed or eligible for listing on the National Register of Historic Places. If the project will adversely affect property that meets the National Historic Register criteria, the Colorado State Historic Preservation Office will recommend ways to avoid or mitigate that adverse affect.

16.0 COLORADO DEPARTMENT OF TRANSPORTATION

The Colorado Department of Transportation is responsible for compliance with Colorado state requirements for road design and construction. This agency's responsibilities in the case of the North Fork Coal EIS will probably be limited to review and approval of applications for any upgraded road access permits. The Colorado Department of Transportation also monitors traffic loads on highways to ensure that proper maintenance is completed and that any future highway expansions to handle traffic are budgeted.

17.0 COLORADO DEPARTMENT OF LOCAL AFFAIRS

The Colorado Department of Local Affairs does not have any regulatory authority; however, this group is responsible for distribution of energy impact tax funds and revenues received as part of the reimbursement of federal royalties from coal mining to the states. Responsibilities of this agency are to review the needs of energy impacted counties within the state and distribute funds for various projects that alleviate the economic impacts of such development. The Colorado Department of Local Affairs considers applications for funding from counties and communities.

18.0 DELTA COUNTY

Delta County has no zoning requirements.

Delta County does require permits to construct permanent buildings. The applications for building permits require detailed plans for structures including electrical plans, plumbing plans, floor layout, sewage facilities, location of wells (if applicable), drainage plans, size and shape of the buildings, access, size and shape of the foundation walls, beams, air vents, window access, and heating and cooling mechanical aspects. Permits are issued upon approval of the plans. The county may inspect the buildings during construction.

19.0 GUNNISON COUNTY

Gunnison County has zoning requirements which are overseen by the Gunnison County Planning Department. Special Use permits for activities in the county must be obtained prior to construction.

Gunnison County also has building permit requirements similar to Delta County.

Appendix C

Unsuitability Analysis Report Iron Point Coal Lease Tract

NOTE: See *Figure C/D-1, Coal Unsuitability Criteria Locations*. This figure is included with the second volume of the EIS.

DESCRIPTION OF THE FEDERAL LANDS INVOLVED

This unsuitability analysis has been prepared for the Iron Point Tract, a 3,404.28 acre tract of federal coal lands described as:

T12S, R91W, 6th Principal Meridian,	
Section 33, Lots 1 to 16, inclusive, and S½N½;	776.00 acres
Section 34, Lots 1 to 16, inclusive, and S½N½;	782.20 acres
T13S, R91W, 6th Principal Meridian,	
Section 2, SW¼NW¼, NW¼SW¼, E½SW¼;	160.00 acres
Section 3, Lots 1 to 4, inclusive, S½N½ and N½S½;	483.04 acres
Section 4, Lots 1 to 4, inclusive, S½N½ and S½;	643.04 acres
Section 5, S½SE¼, SE¼SW¼;	120.00 acres
Section 8, NE¼;	160.00 acres
Section 9, NW¼, N½SW¼;	240.00 acres
Section 11, NE¼NW¼;	120.00 acres

This tract was identified as a result of a coal lease application submitted by Bowie Resources, Ltd. (Bowie) in August 1977. The tract lies approximately 4 miles east of the town of Somerset in Delta County, Colorado. Approximately 2,801 acres are federal surface and federal minerals. The USDA Forest Service (Forest Service) manages the surface of 1,558 acres and the Bureau of Land Management (BLM) manages 1,243 acres. The remainder of the surface (602 acres) is owned by Bowie and William G. Hughes, Pat A. Hughes and Brian C. Hughes; the mineral estate is federally owned. The tract lies adjacent to two existing producing coal mines.

As a first step in this analysis, the preliminary mining plan submitted by the applicant was examined in order to identify areas in which the proposed underground mining operation would produce surface effects. All of the areas on which surface facilities associated with the proposed operation were to be located and all the areas identified as likely to be affected by subsidence were delineated as having surface effects.

The unsuitability criteria were then applied individually to the areas identified as having surface effects. Each criterion was applied individually and maps were developed showing the applicability of the criterion. Then after all criteria had been applied, the exceptions of each criterion found to be applicable were then examined to determine if the exceptions were also applicable.

Finally, after the process had been completed, a summary, stating the conclusions of the report was written.

In compiling this analysis and report, the unsuitability criteria published in 43 CFR 3461 were used. The unsuitability criteria were applied individually to the area being considered. Exceptions to certain criteria allow areas to be considered further even though they have been determined to be unsuitable. These exceptions to the criteria are noted where applied.

ANALYSIS OF THE UNSUITABILITY CRITERIA

Criteria exemptions are not described. Exceptions to the criteria are described only if they apply.

Criterion 1

All federal lands included in the following land systems or categories shall be considered unsuitable: National Park System, National Wildlife Refuge System, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers System, National Recreation Areas, lands acquired with money derived from the Land and Water Conservation Fund, National Forests, and federal lands in incorporated cities, towns, and villages.

Exceptions. (I) A lease may be issued within the boundaries of any National Forest if the Secretary finds no significant recreational, timber, economic or other values which may be incompatible with the lease; and (A) surface operations and impacts are incident to an underground coal mine, or (B) where the Secretary of Agriculture determines, with respect to lands which do not have significant forest cover within those National Forests west of the Meridian, that surface mining may be in compliance with the Multiple-Use Sustained-Yield Act of 1960, the Federal Coal Leasing Amendments Act of 1976 and the Surface Mining Control and Reclamation Act of 1977.

Analysis

The lands within Sections 33 and 34 T13S, R91W, 6th PM were proclaimed National Forest on June 6, 1905 and are within the Gunnison National Forest. Conditions under which coal leasing may occur are listed in the Amended Land and Resource Management Plan (LRMP), Grand Mesa, Uncompahgre and Gunnison National Forests - General Direction on pages III-62 through III-70 and in the Grand Mesa, Uncompahgre and Gunnison National Forests Oil and Gas Leasing Environmental Impact Statement.

The stipulations set forth in these documents will protect specific resources which are found on the lease, and thereby satisfy the condition that the "Secretary finds no significant recreational, timber, economic or other values which may be incompatible with the lease." In addition, surface operations and impacts are incident to an underground coal mine.

Criterion 2

Federal lands that are within rights-of-way or easements or within surface leases for residential, commercial, industrial, or other public purposes, on federally-owned surface shall be considered unsuitable.

Exceptions. A lease may be issued and mining operations approved, in such areas if the surface management agency determines that (i) all or certain types of coal development (e.g., underground mining) will not interfere with the purpose of the right-of-way or easement, or (ii) the right-of-way or easement was granted for mining purposes, or (iii) the right-of-way or easement was issued for a purpose for which it is not being used, or (iv) the parties involved in the right-of-way or easement agree, in writing, to leasing, or (v) it is impractical to exclude such areas due to the location of coal and method of mining and such areas or uses can be protected through appropriate stipulations.

Analysis

There are two rights-of-way located on the application lands managed by the BLM, a powerline (COC-22713) and Delta County Road 44.05 Drive (COC-42671, Hubbard Creek Road), totaling 24 acres. Lands involved in these rights-of-way are suitable for coal leasing after applying the exceptions to the criteria. The road R/W is protected by Criterion No. 3 (see below); the powerline will be protected by exception (v) above. The powerline right-of-way is 125 feet in width and includes access roads. In order to protect the powerline, the following lease stipulation will be required:

State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) shall be used to control subsidence. No mining related surface disturbances will occur within 100 feet of the outside line of the powerline right-of-way without a written finding from the Authorized Officer and consultation with the right-of-way holder. These techniques would provide for maximum coal removal while insuring that sufficient coal is left in place to prevent subsidence.

There is a General Land Office Order, 6/1/1910, which classifies the lands within the application area for coal. The lands are also within the Paonia-Somerset Known Recoverable Resource Area, COC-20093. No other easements or surface leases for residential, commercial, industrial, or other public purposes are determined to exist within the review area.

Criterion 3

Federal lands affected by section 522(e)(4) and (5) of the Surface Mining Control and Reclamation Act of 1977 shall be considered unsuitable. This includes lands within 100 feet of the outside line of the right-of-way of a public road, or within 100 feet of a cemetery, or within 300 feet of any public building, school, church, community or institutional building or public park, or within 300 feet of an occupied dwelling.

Exceptions. A lease may be issued for lands (i) used as mine access roads or haulage roads that join the right-of-way for a public road, (ii) for which the Office of Surface Mining Reclamation and Enforcement has issued a permit to have public roads relocated, (iii) if, after public notice and opportunity for public hearing in the locality, a written finding is made by the Authorized Officer that the interests of the public and the landowners affected by mining within 100 feet of a public road will be protected, or (iv) for which owners of occupied dwellings have given written permission to mine within 300 feet of their buildings.

Analysis

Approximately 900 feet of (1.2 acres) public road, Delta County Road 44.05 Drive, is located on the proposed lease tract. No occupied dwellings, public buildings, schools, churches, community, or institutional buildings exist within this area.

All of the lands affected by this criterion are suitable for coal leasing with application of the exceptions. A lease stipulation will be required to protect the public road from surface disturbance and subsidence. Hubbard Creek County Road will be protected from surface disturbance and subsidence due to mining by the following stipulation:

> No mining related disturbances will occur within 100 feet of the outside line of the right-of-way of Hubbard Creek County Road (44.05 Drive). The angle of draw used to protect the road from subsidence will be dictated by the approved Colorado DMG Mining and Reclamation Plan, (the estimated angle of draw is conservatively estimated to be 25 degrees). However, mining related disturbances may occur if, after public notice and the opportunity for public hearing in the locality, a written finding is made by the Authorized Officer that the interests of the public and the landowners affected by mining within 100 feet of a public road will be protected.

Criterion 4

Federal lands designated as wilderness study areas shall be considered unsuitable while under review by the Administration and Congress for possible wilderness designation. For any federal land which is to be leased or mined prior to completion of the wilderness inventory by the surface management agency, the environmental assessment or impact statement on the lease sale or mine plan shall consider whether the land possesses the characteristics of a wilderness study area. If the finding is affirmative, the land shall be considered unsuitable, unless issuance of noncompetitive coal leases and mining on leases is authorized under the Wilderness Act and the Federal Land Policy and Management Act of 1976.

Analysis

No lands within the review area are designated Wilderness Study Areas.

Criterion 5

Scenic federal lands designated by visual resource management analysis as Class I (an area of outstanding scenic quality or high visual sensitivity) but not currently on the National Register of Natural Landmarks shall be considered unsuitable. A lease may be issued if the surface management agency determines that surface coal mining operations will not significantly diminish or adversely affect the scenic quality of the designated area.

Analysis

No lands within the review area are designated as visual resource management Class I areas.

Criterion 6

Federal lands under permit by the surface management agency, and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments shall be considered unsuitable for the duration of the study, demonstration, or experiment except where mining could be conducted in such a way as to enhance or not jeopardize the purposes of the study, as determined by the surface management agency, or where the principal scientific use or agency give written concurrence to all or certain methods of mining.

Analysis

No lands within the review area are under permit for scientific study.

Criterion 7

All publicly-owned places on federal lands which are included in the National Register of Historic Places shall be considered unsuitable. This shall include any areas that the surface management agency determines, after consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Officer, are necessary to protect the inherent values of the property that made it eligible for listing in the National Register.

Analysis

No publicly-owned places on federal or fee lands within the review area are included in the National Register of Historic Places.

Criterion 8

Federal lands designated as natural areas or as National Natural Landmarks shall be considered unsuitable.

Analysis

No lands within the review area are designated as natural areas or as National Natural Landmarks.

Criterion 9

Federally designated critical habitat for listed threatened or endangered plant and animal species, and habitat proposed to be designated as critical for listed threatened or endangered plant and animal species or species proposed for listing, and habitat for federal threatened or endangered species which is determined by the Fish and Wildlife Service and the surface management agency to be of essential value and where the presence of threatened or endangered species has been scientifically documented, shall be considered unsuitable.

Exceptions. A lease may be issued and mining operations approved if, after consultation with the Fish and Wildlife Service, the Fish and Wildlife Service determines that the proposed activity is not likely to jeopardize the continued existence of the listed species and/or its critical habitat.

Analysis

No lands within the review area are designated as critical habitat, proposed to be designated as critical habitat, or determined to be essential habitat for any federally listed threatened or endangered plant or animal species, or species proposed for listing (Federal Register, various dates). However, critical habitat for the Colorado squawfish, Razorback sucker, Humpback chub, and Bonytail chub does exist off-site in the Colorado River drainage which potentially could be affected by water depletion from this action (Federal Register/Vol. 59, No. 54). The Fish and Wildlife Service has concluded that any water depletion in the upper Colorado River Basin "may effect" these endangered fish species and their critical habitat. At this time no specific projections of water depletions that may result from development of the review area are available. At the post-leasing stage, prior to the approval of the mine plan, if it is determined that development of the lease would result in water depletions in the upper Colorado River Basin, the permitting agency must enter into consultation with the Fish and Wildlife Service to determine the appropriate conservation measures to offset the effect to these listed fish.

Potential habitat for southwest willow flycatchers is known to be present in Hubbard Creek, just off the proposed lease tract. Within the study area, potentially suitable habitat for this species may exist in the riparian zones of Terror Creek and Hubbard Creek. No data currently indicates that the species is present in the review area or that there is any essential habitat on the review area. Prior to any disturbance within a riparian zone, the lessee must conduct inventories to determine if suitable habitat is present for this species, and if so, must conduct inventories for the species prior to authorization being granted for the disturbance. If the species is present, consultation with the Fish and Wildlife Service will determine the appropriate conservation measures, which may include avoidance of suitable habitat, a seasonal constraint within 150 feet of the occupied habitat, or the improvement of an off-site habitat area to benefit southwest willow flycatchers.

The following list of federally listed endangered, threatened, and candidate species are known to occur on the review area and/or in the region of potential effect of this action and were considered under this criterion (species list provided by the Fish and Wildlife Service, 1998):

Black-footed ferret	*Mustela nigripes*	END
Crane, whooping	*Grus americana*	END
Mexican spotted owl	*Strix occidentalis*	THR
Bald eagle	*Haliaeetus leucocephalus*	THR
Southwest willow flycatcher	*Empidonax traillii traillii*	END
Peregrine falcon	*Falco peregrinus anatum*	END
Bonytail chub	*Gila elegans*	END
Colorado squawfish	*Ptychocheilus lucius*	END
Humpback chub	*Bila cypha*	END
Razorback sucker	*Xyrauchen texanus*	END
Uinta basin hookless cactus	*Sclerocactus glaucus*	THR
Clay loving wild buchwheat	*Erigonum pelinophilum*	END

Criterion 10

Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as endangered or threatened shall be considered unsuitable.

Exceptions. A lease may be issued and mining operations approved if, after consultation with the state, the surface management agency determines that the species will not be adversely affected by all or certain stipulated methods of coal mining.

Analysis

No lands within the review area, or off-site that would be affected by this action, have been determined by the state of Colorado as critical or essential habitat for any state listed endangered or threatened animal species. No plant species are listed by the state of Colorado as threatened or endangered. In addition to the species appearing on the federal list above, the river otter (*Lutra conadensis*), boreal toad (*Bufo boreas boreas*), and Canada lynx (*Lynx canadensis*), listed endangered by the state of Colorado, were considered as potentially occurring on the review area or in the region of potential effect and were considered under this criterion. Typical lynx habitat is over 9,000 feet in elevation, which is higher than the review area. Current data indicates that the lynx may be confined to isolated locations in the central part of the state. It is unlikely that the species would occur on the review area. River otters are known to occur in the Gunnison Gorge, and they have been reported in the North Fork of the Gunnison River. No data indicates that the species has been found in the streams on the review area. Grand Mesa is historic habitat for the boreal toad, which requires marsh, pond, bog, or wet meadow habitat in spruce-fir forests or alpine meadows, at elevations above 8,000 feet, for breeding (Boreal Toad Recovery Plan, 1994). There is no data to indicate that the review area has these habitat types at the required elevation.

Criterion 11

A bald or golden eagle nest site on federal lands that is determined to be active, and an appropriate buffer zone of land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

Exceptions. A lease may be issued if (1) it can be conditioned in such a way, either in manner or period of operation, that eagles will not be disturbed during the breeding season, or (2) the surface management agency, with the concurrence of the Fish and Wildlife Service, determines that the golden eagle nest(s) will be moved, or (3) buffer zones may be decreased if the surface management agency determines that the active eagle nests will not be adversely affected.

Analysis

Presently, no bald or golden eagle nest sites exist on federal lands within the review area. Three known golden eagle nests are located off the northeast corner of the review area; one nest location is within one-half mile of the eastern boundary of the review area in Section 35. A buffer zone of one-quarter mile radius around bald and golden eagle nest sites was suggested as adequate protection in the Uinta-Southwestern Utah Coal Region EIS. Present guidelines used by the Fish and Wildlife Service are:

Bald Eagle

1. Year round closure to surface occupancy (beyond that which historically occurred in the area) within a one-quarter mile radius of nests,

2. No activity from November 15 through July 30 within a one-half mile radius of active bald eagle nests. Total potential area of protection is a one-half mile radius of the nest.

Golden Eagle

1. No surface occupancy (beyond that which historically occurred in the area) within a one-quarter mile radius of the nest site and associated alternate nests,

2. Seasonal restrictions to human encroachment within one-half mile of the nest and any alternate nests from February 1 through July 15

Underground coal mining and nesting bald or golden eagles are compatible on the same tract of land unless surface facilities or surface disturbances cause nest-site abandonment. With respect to bald or golden eagle nests which may be established on the review area during the life of the project, the following special stipulations shall apply:

1. No new permanent surface facilities or disturbances except subsidence shall be located within a one-quarter mile radius buffer zone around each bald or golden eagle nest site.

2. No surface activities will be allowed within a one-half mile radius buffer zone around each active eagle nest site from November 15 to July 30 for bald eagles and February 1 to July 15 for golden eagles.

3. Any proposed surface facilities, disturbances or activities (as noted above) in or adjacent to these buffer zones will require approval from the surface management agency on a site-specific basis, alter consultation with the Fish and Wildlife Service.

Criterion 12

Bald and golden eagle roost and concentration areas on federal lands used during migration and wintering shall be considered unsuitable.

Analysis

No bald or golden eagle roost or concentration areas are known to exist on federal lands within the review area. Bald eagle use in this area, both along the North Fork of the Gunnison River above Paonia and the uplands has been determined as light by the BLM and Forest Service. Bald eagles use the review area sporadically for foraging.

With respect to bald or golden eagle roost sites or concentration areas which may be established on the review area during the life of the project, the following special stipulation shall be applied:

1. No surface activity except subsidence shall occur within a one-quarter mile radius of winter roosts between November 15 and March 15, development may be permitted at other periods. If periodic visits are required within the buffer zone after development, activity should be restricted to the hours of 10:00 a.m. and 2:00 p.m. from November 15 through March 15.

Criterion 13

Federal lands containing a falcon (excluding kestrel) cliff nesting site with an active nest and buffer zone of federal land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

Exception. A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the falcon habitat during the periods when such habitat is used by the falcons.

Analysis

No falcon cliff nesting sites are known to exist on federal lands within the review area. Available cliff sites for nesting within the review area are short, and atypical of the cliff sites being selected by peregrine and prairie falcons for nesting elsewhere in the local areas.

Criterion 14

Federal lands which are high priority habitat for migratory bird species of high federal interest on a regional or national basis, as determined jointly by the surface management agency and the Fish and Wildlife Service, shall be considered unsuitable.

Exception. A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the migratory bird habitant during the periods when such habitat is used by the species.

Analysis

The following list of migratory bird species of high federal and/or state interest are known, or considered likely, to breed and nest within the review area or vicinity:

Band-tailed pigeon
Black swift
Cooper's hawk
Flammulated owl
Golden eagle
Great blue heron
Loggerhead shrike
Lewis' woodpecker
Peregrine falcon
Prairie falcon
Three-toed Woodpecker
Williamson's sapsucker
Northern Goshawk

Also, a total of eighty-six species of neotropical migrant birds are known to breed or migrate regularly through some part of Colorado. Recent studies in Colorado conclude that 41% of these neotropical migrant species are declining in numbers. The study also showed that riparian communities, followed by gambel oak communities support the highest number of breeding bird.

Underground coal mining would impact these species to the degree that the human and surface-disturbing activities would impact their breeding and nesting activities and habitats in riparian and gambel oak communities. Of particular high importance are the riparian areas throughout the review area, specifically in Terror Creek and Hubbard Creek. Riparian areas are suitable for coal leasing only with inclusion of the following special stipulation to protect the above mentioned migratory bird species:

1. A one-eighth mile buffer zone (660 feet) will be protected on either side of riparian zones (or a buffer zone may be established in accordance with the surface management agency guidelines).

2. No surface disturbances, except surface subsidence, will be permitted within these buffer zones, unless no practical alternatives exist.

3. Other raptors (except American kestrel):

    a. Conduct surveys for nesting raptors on the lease tract prior to development of any surface facilities.

    b. No surface activities will be allowed within a one-half mile radius of active nest sites between the dates of February 1 and August 15, unless authorized by the BLM or Forest Service on a site specific basis.

4. All unavoidable surface disturbance will require approval of the Forest Service or BLM Authorized Officer. The BLM or Forest Service will coordinate with the Fish and Wildlife Service and the Colorado Division of Wildlife to determine the type and extent of allowable variances. A site specific analyses will determine if this stipulation will apply.

Criterion 15

Federal lands which the surface management agency and the state jointly agree are habitat for resident species of fish, wildlife and plants of high interest to the state and which are essential for maintaining these priority wildlife and plant species shall be considered unsuitable. Examples of such lands which serve a critical function for the species involved include: (i) active dancing and strutting grounds for sage grouse, sharp-tailed grouse, and prairie chicken, (ii) winter ranges crucial for deer, antelope, and elk, (iii) migration corridor for elk, and (iv) extremes of range for plant species.

Exceptions. A lease may be issued if, after consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected.

Analysis

According to the Colorado Division of Wildlife's current mapping of seasonal ranges for mule deer and elk, none of the lands in the review area are considered to be crucial winter range (winter concentration area or severe winter range). Current Colorado Division of Wildlife mapping of winter ranges indicates that the entire review area is winter range for elk, and portions of Sections 8, 9, and 11 on the south end of the review area are considered winter range for mule deer. Surface disturbing activities in this area caused by underground coal mining would impact elk and mule deer winter ranges. The review area is suitable for coal leasing only with inclusion of the following special protective stipulations on those areas that may be designated as crucial winter range during the life of the project:

1. Coal related facilities and surface disturbances except subsidence will be authorized in the review area only if no practical alternatives exist.

2. The BLM and Forest Service will coordinate with the Colorado Division of Wildlife to determine the type and extent of allowable variances.

3. Coal exploration, facility construction, and major scheduled maintenance will not be authorized within crucial winter ranges from December 1 through April 30.

4. All unavoidable surface disturbances within the crucial winter ranges during these times will require approval of the BLM and Forest Service Authorized Officer.

No other federal lands within the review area, or off-site that would be affected by the proposed action are considered critical or essential habitat for resident species of fish, wildlife or plants of high interest to the state of Colorado.

Criterion 16

Federal lands in riverine, coastal, and special floodplains (100-year recurrent interval) on which the surface management agency determines that mining could not be undertaken without substantial threat of loss of life or property shall be considered unsuitable for all or certain stipulated methods of coal mining.

Analysis

The application lands are not within a riverine, coastal or special floodplain.

Criterion 17

Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.

Analysis

None of the lands in the proposed lease tract are within a municipal watershed.

Criterion 18

Federal lands with National Resource Waters, as identified by states in their water quality management plans, and a buffer zone of federal lands one-quarter mile from the outer edge of the far banks of the water, shall be unsuitable.

Analysis

None of the lands in the proposed lease tract are identified as National Resource Water.

Criterion 19

Federal lands identified by the surface management agency, in consultation with the state in which they are located, as alluvial valley floors according to the definition in Subpart 3400.0-5(a) of this title, the standards of 30 CFR Part 822, the final alluvial floor guidelines of the Office of Surface Mining Reclamation and Enforcement when published, and approved state programs under the Surface Mining Control and Reclamation Act of 1977, where mining would interrupt, discontinue, or preclude farming, shall be considered unsuitable. Additionally, when mining federal land outside an alluvial

valley floor would materially damage the quantity or quality of water in surface or underground water systems that would supply alluvial valley floors, the land shall be considered unsuitable.

Analysis

The application lands are not within an alluvial valley floor, but such lands drain into the North Fork of the Gunnison River, along which both surface irrigated and potentially irrigable sites exist. However, material damage to the quality and quantity of water arising on or flowing over the proposed lease tract is not anticipated.

Criterion 20

Federal lands in a state to which is applicable a criterion (i) proposed by the state or Indian tribe located in the planning area, and (ii) adopted by rulemaking by the Secretary, shall be considered unsuitable.

Analysis

This criterion is not presently in effect in the state of Colorado.

SUMMARY

The Iron Point Tract was determined to be suitable for coal mining following the application of Unsuitability Criteria numbers 4, 5, 6, 7, 8, 10, 13, 16, 17, 18, 19 and 20.

Criterion Numbers 1, 2, 3, 9, 11, 12, 14 and 15 were found to be unsuitable for mining, however, after applying the exceptions to the criterion, they were suitable for mining with the following restrictions:

Criterion 1: The lands within Sections 33 and 34, T13S, R91W, 6th PM were proclaimed National Forest on June 6, 1905 and are within the Gunnison National Forest. These lands are considered suitable for coal mining after applying the exception to Criteria number 1.

Criterion 2: State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) shall be used to control subsidence. No mining related surface disturbances will occur within 100 feet of the outside line of the powerline right-of-way without a written finding from the Authorized Officer and consultation with the right-of-way holder. These techniques would provide for maximum coal removal while insuring that sufficient coal is left in place to prevent subsidence.

Criterion 3: No mining related disturbances will occur within 100 feet of the outside line of the right-of-way of Hubbard Creek County Road (44.05 Drive). The angle of draw used to protect from subsidence will be dictated by the approved Division of Mining and Geology Mining and Reclamation Plan, (the estimated angle of draw is conservatively estimated to be 25 degrees). However, mining related disturbances may occur if, after public notice and the opportunity for public hearing in the locality, a written finding is made by the Authorized Officer that the interests of the public and the landowners affected by mining within 100 feet of a public road will be protected.

Criterion 9: For water depletions, as part of the Mine Permit Application Package, the lessee shall furnish to the Regulatory Officer of the Office of Surface Mining an estimate of the average annual water depletion resulting from the proposed action. Consultation with the Fish and Wildlife Service may be required for any planned depletions. Conservation measures for the depletion will be determined during consultation. Conservation measures may include a one time payment, per acre-foot, to the Recovery Program at a fee to be established by the Fish and Wildlife Service.

Arrangements for receiving the remitted funds from the lessee will be coordinated directly with the lessee by the Office of Surface Mining.

No surface disturbance or facilities will be located in occupied southwest willow flycatcher habitat. Prior to any planned disturbance within riparian habitats on the lease, the lessee must: 1) Survey the area of the proposed disturbance for suitable southwest willow flycatcher habitat, and survey all suitable habitat for the presence of the species. All habitat and species surveys must be in accordance with the accepted Fish and Wildlife Service protocol; 2) Provide the results of all surveys to the Fish and Wildlife Service, the Montrose District of the BLM and the Paonia Ranger District of the Forest Service; 3) If suitable habitat or individuals are located in the area, consultation with the Fish and Wildlife Service will be required to determine suitable conservation measures to prevent a "take" under section 9 of the Endangered Species Act. Conservation measures may include avoidance of the occupied habitat, establishment of a buffer zone and seasonal restriction around occupied habitat, or others developed for the specific site. In accordance with current protocol, surveys for the presence of the species are valid for only one year.

Criteria 11: With respect to bald or golden eagle nests which may be established on the review area during the life of the project, the following special stipulations shall be applied:

1. No new permanent surface facilities or disturbances except subsidence shall be located within a one-quarter mile radius buffer zone around each bald or golden eagle nest site.

2. No surface ground activities will be allowed within a one-half mile radius buffer zone around each bald eagle active nest site from November 15 to July 30, and around each active golden eagle nest site from February 1 to July 15.

3. Any proposed surface facilities, disturbances or activities (as noted above) in, or adjacent to these buffer zones will require approval from the BLM or Forest Service, on a site-specific basis, after consultation with the Fish and Wildlife Service.

Criterion 12: With respect to bald or golden eagle roost sites or concentration areas which may be established on the review area during the life of the project the following special stipulation shall be applied:

1. No surface ground activity except subsidence shall occur within a one-quarter mile radius of winter roosts between November 15 and March 15, development may be permitted at other periods. If periodic visits are required within the buffer zone after development, activity should be restricted to the hours of 10:00 a.m. and 2:00 p.m. from November 15 through March 15.

Criterion 14: Riparian zones are present within the review area and are suitable for coal leasing only with inclusion of the following special stipulations to protect resident and migratory bird species:

1. A one-eighth mile buffer zone (660 feet) will be protected on either side of riparian zones (or a buffer zone may be established in accordance with the surface management agency guidelines). No surface disturbances, except surface subsidence, will be permitted within these buffer zones, unless no practical alternatives exist. All unavoidable surface disturbance will require approval of the Forest Service or BLM's Authorized Officer. The BLM or Forest Service will coordinate with the Fish and Wildlife Service and the Colorado Division of Wildlife to determine the type and extent of allowable variances. A site specific analyses will determine if this stipulation will apply.

2. With respect to other raptors (except American kestrel) which may occur or become established on the Iron Point Tract during the life of the project, the following special stipulation shall apply:

Conduct surveys for nesting raptors on the lease tract prior to development of any surface facilities. No surface activities will be allowed within a one-half mile radius of active nest sites between the dates of February 1 and August 15, unless authorized by the BLM or Forest Service on a site-specific basis.

Criterion 15: If areas are determined by the Colorado Division of Wildlife to be mule deer and elk crucial winter range, the following stipulation shall be applied:

1. Coal related facilities and surface disturbances except subsidence will be authorized in the review area only if no practical alternatives exist. The BLM and Forest Service will coordinate with the Colorado Division of Wildlife to determine the type and extent of allowable variances. Coal exploration, facility construction, and major scheduled maintenance will not be authorized within these crucial winter ranges from December 1 through April 30. All unavoidable surface disturbances within these crucial winter ranges during these times will require approval of the Authorized Officer.

REFERENCES

Bureau of Land Management, Various dates, unpublished Wildlife Inventories and Observations, Uncompahgre Basin Resource Area. Montrose, Colorado.

Colorado State Statutes, 1988. Division of Wildlife and Division of Parks and Outdoor Recreation, Title 33, Chapter 10, Article 11 and 111.

Federal Register. 1990. Vol. No., U.S. Department of the Interior, Fish and Wildlife Service, Washington DC.

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Federal Register. 1991, Vol. No., U.S. Department of the Interior, Fish and Wildlife Service, Washington DC.

U.S. Department of the Interior, 1983. Uinta-Southwestern Utah Coal Region Environmental Impact Statement, U.S. Department of the Interior, Bureau of Land Management, Utah State Office, Salt Lake City, Utah.

U.S. Fish and Wildlife Service, 1992. Informal Section 7 Consultation, Western Colorado Suboffice, Grand Junction, CO.

CONSULTATION AND COORDINATION

The following agencies and organizations were contacted to gain information pertinent to the application of the 20 coal suitability criteria:

Federal Agencies

U.S. Department of the Interior
Fish and Wildlife Service
Western Colorado Suboffice
529 251/2 Road
Grand Junction, CO 81505-6199

Office of Surface Mining

Department of Energy, WAPA

Colorado State Agencies

Division of Wildlife, Southwest Region Office, Montrose, CO
Colorado Division of Minerals and Geology

County Agencies

Delta County Planning Department

Appendix D

Unsuitability Analysis Report
Elk Creek Coal Lease Tract

NOTE: See *Figure C/D-1, Coal Unsuitability Criteria Locations*. This figure is included within the second volume of the EIS.

DESCRIPTION OF THE FEDERAL LANDS INVOLVED

This unsuitability analysis has been prepared for the Elk Creek Tract, a 2.81± acre tract of federal coal lands described as:

T12S, R90W, 6th Principal Meridian	
Section 31, All;	733 acres
Section 32, Lots 3 to 6 and 11 to 14, inclusive; NW¼	493 acres
T12S, R92W, 6th Principal Meridian	
Section 35, E½	478 acres
Section 36, All	954 acres
T13S, R90W, 6th Principal Meridian	
Section 5, Lots 7 to 10, inclusive;	124 acres
Section 6, Lots 8 to 17, inclusive;	317 acres
T13S, R91W, 6th Principal Meridian	
Section 1, Lots 1 to 4, inclusive, S½NW¼, SW¼;	403 acres
Section 2, Lots 1, S½NE¼;	121 acres
Section 12, S½NE¼, NW¼;	240 acres

This tract was identified as a result of a coal lease application submitted by Oxbow Mining, Inc. (Oxbow) in November 1997. The tract lies northwest of the town of Somerset in Delta and Gunnison counties, Colorado. Approximately 1,702 acres are federal surface and federal minerals. The USDA Forest Service (Forest Service) manages the surface of 806 acres and the USDI Bureau of Land Management (BLM) manages 896 acres. The remainder of the surface (2,161 acres) is owned by Hotchkiss Ranches, Inc.; the mineral estate is federally owned. The tract lies between the two existing producing coal mines. The applicant's lease application was amended to include an additional 160 acres lying on the northeastern boundary of the application area in T12S, R90W, Section 31, 6th PM. The additional area was incorporated into the tract to ensure all federal coal, for which there was adequate coal data, was included to avoid a potential bypass of coal in the future. The Elk Creek Tract lies to the east of federal coal lease COC-53510 which is leased by Oxbow and is operated as the Sanborn Creek Mine.

As a first step in this analysis, the preliminary mining plan submitted by the applicant was examined in order to identify areas in which the proposed underground mining operation would produce surface effects. All of the areas on which surface facilities associated with the proposed operation were ocated and all of the areas identified as likely to be affected by subsidence were delineated as having surface effects.

The unsuitability criteria were then applied individually to the areas identified as having surface effects. Each criterion was applied individually and maps were developed showing the applicability of the criterion. Then after all criteria had been applied, the exceptions of each criterion found to be applicable were examined to determine if the exceptions were also applicable.

Finally, after the process had been completed, a summary stating the conclusions of the report was written.

In compiling this analysis and report, the unsuitability criteria published in 43 CFR 3461 were used. The unsuitability criteria were applied individually to the area being considered. Exceptions to certain criteria allow areas to be considered further even though they have been determined to be unsuitable. These exceptions to the criteria are noted where applied.

ANALYSIS OF THE UNSUITABILITY CRITERIA

Exemptions to the criteria are not described. Exceptions to the criteria are described only if they apply.

Criterion 1

All federal lands included in the following land systems or categories shall be considered unsuitable: National park System, National Wildlife Refuge System, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers System, National Recreation Areas, lands acquired with money derived from the Land and Water Conservation Fund, National Forests, and federal lands in incorporated cities, towns, and villages.

Exceptions. (I) A lease may be issued within the boundaries of any National Forest if the Secretary finds no significant recreational, timber, economic or other values which may be incompatible with the lease; and (A) surface operations and impacts are incident to an underground coal mine, or (B) where the Secretary of Agriculture determines, with respect to lands which do not have significant forest cover within those National Forests west of the Meridian, that surface mining may be in compliance with the Multiple-Use Sustained-Yield Act of 1960, the Federal Coal Leasing Amendments Act of 1976 and the Surface Mining Control and Reclamation Act of 1977.

Analysis

Some of the lands within Section 35, T12S, R91W, and Section 32, T12S, R90W, 6th PM were proclaimed National Forest on June 6, 1905 and are within the Gunnison National Forest. Conditions under which coal leasing may occur are listed in the Amended Land and Resource Management Plan (LRMP), Grand Mesa, Uncompahgre and Gunnison National Forests - General Direction on pages III-62 through III-70 and in the Grand Mesa, Uncompahgre and Gunnison National Forests Oil and Gas Leasing Environmental Impact Statement to which the LRMP tiers.

Criterion 2

Federal lands that are within rights-of-way or easements or within surface leases for residential, commercial, industrial, or other public purposes, on federally-owned surface shall be considered unsuitable.

Exceptions. A lease may be issued, and mining operations approved, in such areas if the surface management agency determines that (i) all or certain types of coal development (e.g., underground mining) will not interfere with the purpose of the right-of-way or easement, or (ii) the right-of-way or easement was granted for mining purposes, or (iii) the right-of-way or easement was issued for a purpose for which it is not being used, or (iv) the parties involved in the right-of-way or easement agree, in writing, to leasing, or (v) it is impractical to exclude such areas due to the location of coal and method of mining and such areas or uses can be protected through appropriate stipulations.

Analysis

There is a right-of-way for a powerline and road (COC-41183) located on the application lands managed by the BLM. The right-of-way is authorized to Oxbow and used for mining purposes. Lands involved in this right-of-way are suitable for coal leasing after applying the exceptions to the criteria.

The road R/W is an exception to Criterion No. 2 by Exception (ii) above. There is a General Land Office Order, 6/1/1910, which classifies the lands within the application area for coal. The lands are also within the Paonia-Somerset Known Recoverable Area, COC-20093. No other easements or surface leases for residential, commercial, industrial, or other public purposes are determined to exist within the Elk Creek Tract.

Criterion 3

Federal lands affected by Section 522(e)(4) and (5) of the Surface Mining Control and Reclamation Act of 1977 shall be considered unsuitable. This includes lands within 100 feet of the outside line of the right-of-way of a public road, or within 100 feet of a cemetery, or within 300 feet of any public building, school, church, community or institutional building or public park, or within 300 feet of an occupied dwelling.

Analysis

No public roads, occupied dwellings, public buildings, schools, churches, community, or institutional buildings exist within the Elk Creek Tract.

Criterion 4

Federal lands designated as wilderness study areas shall be considered unsuitable while under review by the Administration and Congress for possible wilderness designation. For any federal land which is to be leased or mined prior to completion of the wilderness inventory by the surface management agency, the environmental assessment or impact statement on the lease sale or mine plan shall consider whether the land possesses the characteristics of a wilderness study area. If the finding is affirmative, the land shall be considered unsuitable, unless issuance of noncompetitive coal lease and mining on leases is authorized under the Wilderness Act and the Federal Land Policy and Management Act of 1976.

Analysis

No lands within the Elk Creek Tract are designated Wilderness Study Areas.

Criterion 5

Scenic federal lands designated by visual resource management analysis as Class I (an area of outstanding scenic quality or high visual sensitivity) but not currently on the National Register of Natural Landmarks shall be considered unsuitable. A lease may be issued if the surface management agency determines that surface coal mining operations will not significantly diminish or adversely affect the scenic quality of the designated area.

Analysis

No lands within the Elk Creek Tract are designated as visual resource management Class I areas.

Criterion 6

Federal lands under permit by the surface management agency, and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments shall be considered unsuitable for the duration of the study, demonstration, or experiment except where mining could be conducted in such a way as to enhance or not jeopardize the purpose of the

study, as determined by the surface management agency, or where the principal scientific use or agency give written concurrence to all or certain methods of mining.

Analysis

No lands within the Elk Creek Tract are under permit for scientific study.

Criterion 7

All publicly-owned places on federal lands which are included in the National Register of Historic Places shall be considered unsuitable. This shall include any areas that the surface management agency determines, after consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Officer, are necessary to protect the inherent values of the property that make it eligible for listing in the National Register.

Analysis

No publicly-owned places on federal or fee lands within the Elk Creek Tract are included in the National Register of Historic Places.

Criterion 8

Federal lands designated as natural areas or as National Natural Landmarks shall be considered unsuitable.

Analysis

No lands within the Elk Creek Tract are designated as natural areas or as National Natural Landmarks.

Criterion 9

Federally designated critical habitat for listed threatened or endangered plant and animal species, and habitat proposed to be designated as critical for listed threatened or endangered plant and animal species or species proposed for listing, and habitat for federal threatened or endangered species which is determined by the Fish and Wildlife Service and the surface management agency to be of essential value and where the presence of threatened or endangered species has been scientifically documented, shall be considered unsuitable.

Exceptions. A lease may be issued and mining operations approved if, after consultation with the Fish and Wildlife Service, the Fish and Wildlife Service determines that the proposed activity is not likely to jeopardize the continued existence of the listed species and/or its critical habitat.

Analysis

No lands within the Elk Creek Tract are designated as critical habitat, proposed to be designated as critical habitat, or determined to be essential habitat for any federally listed threatened or endangered plant or animal species, or species proposed for listing (Federal Register, various dates). However, critical habitat for the Colorado squawfish, Razorback sucker, Humpback chub, and Bonytail chub does exist off-site in the lower Gunnison River which potentially could be affected by water depletion from this action (Federal Register/Vol. 59, No. 54). The Service has concluded that any water depletion in the upper Colorado River Basin "may effect" these endangered fish species and their critical habitat. At this time, no specific projections of water depletions that may result from development of the review

area are available. At the post-leasing stage, prior to the approval of the mine plan, if it is determined that development of the lease would result in water depletions in the upper Colorado River Basin, the permitting agency must enter into consultation with the Fish and Wildlife Service to determine the appropriate conservation measures to offset the effect of these listed fish.

Potential habitat for southwestern willow flycatchers is known to be present in Hubbard Creek, just off the proposed lease tract. Within the study area, potentially suitable habitat for this species may exist in the riparian zones of Bear and Elk Creeks. No data currently indicates that the species is present in the review area or that there is any essential habitat on the review area. Prior to any disturbance within a riparian zone, the lessee must conduct inventories to determine if suitable habitat is present for this species, and, if so, must conduct inventories for the species prior to authorization being granted for disturbance. If the species is present, consultation with the Fish and Wildlife Service will determine the appropriate conservation measures, which may include avoidance of suitable habitat, a seasonal constraint within 150 feet of the occupied habitat, or the improvement of an off-site habitat area to benefit southwest willow flycatchers.

Peregrine falcons are known to nest on the Uncompahgre Plateau and in the Gunnison Gorge. These birds may use the lease tract for incidental foraging, but no nesting habitat for this species is found on or near the tract.

Bald eagles winter in the area, and may use the tract for incidental foraging. No essential habitat for this species exists on the lease tract.

The following list of federally listed endangered, threatened, and candidate species are known to occur on the Elk Creek Tract and/or in the region of potential effect of this action and were considered under this criterion (species list provided by the Fish and Wildlife Service, 1998). Only the species listed above were found to be potentially effected by the proposed lease.

Black-footed ferret	*Mustela nigripes*	END
Crane, whooping	*Grus americana*	END
Mexican spotted owl	*Strix occidentalis*	THR
Bald eagle	*Haliaeetus leucocephalus*	THR
Southwest willow-flycatcher	*Empidonax traillii traillii*	END
Peregrine falcon	*Falco peregrinus anatum*	END
Bony tail chub	*Gila elegans*	END
Colorado squawfish	*Ptychocheilus lucius*	END
Humpback chub	*Bila cypha*	END
Razorback sucker	*Xyrauchen texanus*	END
Uinta basin hookles cactus	*Sclerocactus glaucus*	THR
Clay loving wild buckwheat	*Erigonum pelinophilum*	END
Canada lynx	*Lynx canadensis*	PROPOSED

Criterion 10

Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as endangered or threatened shall be considered unsuitable.

Exceptions. A lease may be issued and mining operations approved if, after consultation with the state, the surface management agency determines that the species will not be adversely affected by all or certain stipulated methods of coal mining.

Analysis

No lands within the Elk Creek Tract, or off-site that would be effected by this action, have been determined by the state of Colorado as critical or essential habitat for any state listed endangered or threatened animal species. No plant species are listed by the state of Colorado as threatened or endangered. In addition to the species appearing on the Federal list above, the river otter (*lutra canadensis*), boreal toad (*Bufo boreas boreas*), and Canada Lynx (*Lynx canadensis*), listed endangered by the state of Colorado, were considered as potentially occurring on the review area or in the region of potential effect and were considered under this criterion. Typical lynx habitat is over 9,000 feet in elevation, which is higher than the review area. Current data indicates that the lynx may be confined to isolated locations in the central part of the state. It is unlikely that the species would occur on the review area. River otters are known to occur in the Gunnison Gorge, and they have been reported in the North Fork of the Gunnison. No data indicates that the species has been found in the streams on the review area. Grand Mesa is historic habitat for the boreal toad, which requires marsh, pond, bog, or wet meadow habitat in spruce-fir forests or alpine meadows, at elevations above 8,000 feet, for breeding (Boreal Toad Recovery Plan, 1994). There is no data to indicate that the Elk Creek Tract has these habitat types at the required elevation.

Criterion 11

A bald or golden eagle nest site on federal lands that is determined to be active, and an appropriate buffer zone of land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

Exceptions. A lease may be issued if (1) it can be conditioned in such a way, either in manner or period of operation, that eagles will not be disturbed during the breeding season, or (2) the surface management agency, with the concurrence of the Fish and Wildlife Service, determines that the golden eagle nest(s) will be moved, or (3) buffer zones may be decreased if the surface management agency determines that the active eagle nests will not be adversely affected.

Analysis

Presently, no bald or golden eagle nest sites exist on federal lands within the Elk Creek Tract. Three known golden eagle nests are located off the northwest corner of the tract. Two nest locations are within a one-half mile of the eastern boundary of the review area (see Map UC-1). A buffer zone of one-quarter mile radius around bald and golden eagle nest sites was suggested as adequate protection in the Uinta-Southwestern Utah Coal Region EIS. Present guidelines used by the Fish and Wildlife Service are:

Bald Eagle:

1. Year round closure to surface occupancy (beyond that which historically occurred in the area) within a one-quarter mile radius of nests,

2. No activity from November 15 through July 30 within a one-half mile radius of active bald eagle nests. Total potential area of protection is a one-half mile radius of the nest.

Golden Eagle:

1. No surface occupancy (beyond that which historically occurred in the area) within one-quarter mile radius of the nest site and associated alternative nests,

2. Seasonal restrictions to human encroachment within one-half mile of the nest and any alternative nests from February 1 through July 15.

Underground coal mining and nesting bald or golden eagles are compatible on the same tract of land unless surface facilities or surface disturbances cause nest-site abandonment. With respect to bald or golden eagle nests which may be established on the tract during the life of the project, the following special stipulations shall be applied.

1. No new permanent surface facilities or disturbances except subsidence shall be located within a one-quarter mile radius buffer zone around each bald or golden eagle nest site.

2. No surface activities will be allowed within a one-half mile radius buffer zone around each active eagle nest site from November 15 to July 30 for bald eagles and February 1 to July 15 for golden eagles.

3. Any proposed surface facilities, disturbances or activities (as noted above) in or adjacent to these buffer zones will require approval from the surface management agency (on a site-specific basis, after consultation with the Fish and Wildlife Service.

Criterion 12

Bald and golden eagle roost and concentration areas on federal lands used during migration and wintering shall be considered unsuitable.

Analysis

No bald or golden eagle roost or concentration areas are known to exist on federal lands within the Elk Creek Tract. Bald eagle use in this area, both along the North Fork of the Gunnison River above Paonia and the uplands, has been determined as light by the BLM and Forest Service. Bald eagles use the Elk Creek Tract sporadically for foraging.

With respect to bald or golden eagle roost sites or concentration areas which may be established on the Elk Creek Tract during the life of the project, the following special stipulation shall be applied:

1. No surface activity except subsidence shall occur within a one-quarter mile radius of winter roosts between November 15 and March 15, development may be permitted at other periods. If periodic visits are required within the buffer zone after development, activity should be restricted to the hours of 10:00 a.m. and 2:00 p.m. from November 15 through March 15.

Criterion 13

Federal lands containing a falcon (excluding kestrel) cliff nesting site with an active nest and buffer zone of federal land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

Exception. A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the falcon habitat during the periods when such habitat is used by the falcons.

Analysis

No falcon cliff nesting sites are known to exist on federal lands within the Elk Creek Tract. Available cliff sites for nesting within the tract are short, and atypical of the cliff sites being selected by peregrine and prairie falcons for nesting elsewhere in western Colorado.

Criterion 14

Federal lands which are high priority habitat for migratory bird species of high federal interest on a regional or national basis, as determined jointly by the surface management agency and the Fish and Wildlife Service, shall be considered unsuitable.

Exception. A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the migratory bird habitat during the periods when such habitat is used by the species.

Analysis

The following list of migratory bird species of high federal and/or state interest are known, or considered likely, to breed and nest within the Elk Creek Tract or vicinity:

Bank-tailed pigeon	Lewis' woodpecker
Black swift	Peregrine falcon
Cooper's hawk	Prairie falcon
Flammulated owl	Western bluebird
Golden eagle	Williamson's sapsucker
Great blue heron	Northern goshawk
Loggerhead shrike	Three-toed woodpecker

Also, a total of eighty-six species of neotropical migrant birds are known to breed or migrate regularly through some part of Colorado. Recent studies in Colorado conclude that 41 percent of these neotropical migrant species are declining in numbers. The study also showed that riparian communities, followed by Gambel oak communities support the highest number of breeding birds.

Underground coal mining would impact these species to the degree that the human and surface-disturbing activities would impact their breeding and nesting activities and habitats in riparian and Gambel oak communities. Of particular high importance are the riparian areas throughout the review area, specifically in Hubbard Creek, Bear Creek, and Elk Creek. Riparian areas are suitable for coal leasing only with inclusion of the following special stipulation to protect the above mentioned migratory bird species:

1. A one-eighth mile buffer zone (660 feet) will be protected on either side of riparian zones (or a buffer zone may be established in accordance with the surface management agency guidelines).

2. No surface disturbances, except surface subsidence, will be permitted within these buffer zones, unless practical alternatives exist.

3. Other raptors (except American kestrel):

    a. Conduct surveys for nesting raptors on the lease tract prior to development of any surface facilities.

b. No surface activities will be allowed within a one-half mile radius of active nest sites between the dates of February 1 and August 15, unless authorized by the BLM or Forest Service on a site-specific basis.

4. All unavoidable surface disturbance will require approval of the Forest Service and BLM Authorized Officer. The BLM or Forest Service will coordinate with the Fish and Wildlife Service and the Colorado Division of Wildlife to determine the type and extent of allowable variances. A site specific analyses will determine if this stipulation will apply.

Criterion 15

Federal lands which the surface management agency and the state jointly agree are habitat for resident species of fish, wildlife and plants of high interest to the state and which are essential for maintaining these priority wildlife and plant species shall be considered unsuitable. Examples of such lands which serve a critical function for the species involved include: (i) active dancing and strutting grounds for sage grouse, sharp-tailed grouse, and prairie chicken, (ii) winter ranges crucial for deer, antelope, and elk, (iii) migration corridor for elk, and (iv) extremes of range for plant species.

Exception. A lease may be issued if, after consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected.

Analysis

According to GIS data obtained from the Colorado Division of Wildlife, portions of T13S, R91W, 6th PM, Sections 1 and 12, and T13S, R90W, 6th PM, Sections 6 and 7 are mule deer winter range, and all but the extreme northern end of the tract is elk winter range. No crucial winter range for mule deer is located on the tract. Crucial winter range for elk is located in portions of T13S, R91W, 6th PM, Section 12 and in T13S, R90W, 6th PM, Sections 5 and 6. Surface disturbing activities in this area caused by underground coal mining would impact elk and mule deer winter ranges. Forest Service data indicates that Bear Creek, Elk Creek, and Hubbard Creek are migration corridors for elk. The Elk Creek Tract is suitable for coal leasing only with inclusion of the following special protective stipulations on those areas designated as crucial winter range during the life of the project, and for migration corridors for elk:

> Coal related facilities and surface disturbances except subsidence will be authorized in the Elk Creek Tract only if no practical alternatives exist. The BLM and Forest Service will coordinate with the Colorado Division of Wildlife to determine the type and extent of allowable variances. Coal exploration, facility construction, and major scheduled maintenance will not be authorized within crucial winter ranges from December 1 through April 30. All unavoidable surface disturbances within the crucial winter ranges during these times will require approval of the BLM and the Forest Service Authorized Officer. No surface facilities may be constructed in the stream/riparian corridors on the lease tract within a one-eighth mile buffer zone on either side of Hubbard Creek, Bear Creek, or Elk Creek, in order to protect migration corridors. Surface disturbance within the one-eighth mile riparian buffer zone will not take place from December 1 through April 30.

No other federal lands within the Elk Creek Tract, or off-site that would be effected by the proposed action are considered critical or essential habitat for resident species of fish, wildlife or plants of high interest to the state of Colorado.

Criterion 16

Federal lands in riverine, coastal, and special floodplains (100 year recurrence interval) on which the surface management agency determines that mining could not be undertaken without substantial threat of loss of life or property shall be considered unsuitable for all or certain stipulated methods of coal mining.

Analysis

The Elk Creek Tract is not within a riverine, coastal or special floodplain.

Criterion 17

Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.

Analysis

None of the lands in the proposed lease tract are within a municipal watershed.

Criterion 18

Federal lands with National Resource Waters, as identified by states in their water quality management plans, and a buffer zone of federal lands one-quarter mile from the outer edge of the far banks of the water, shall be unsuitable.

Analysis

None of the lands in the proposed lease tract are identified as a National Resource Water.

Criterion 19

Federal lands identified by the surface management agency, in consultation with the state in which they are located, as alluvial valley floors according to the definition in Subpart 3400.0-5(a) of this title, the standards of 30 CFR Part 822, the final alluvial floor guidelines of the Office of Surface Mining Reclamation and Enforcement when published, and approved state programs under the Surface Mining Control and Reclamation Act of 1977, where mining would interrupt, discontinue, or preclude farming, shall be considered unsuitable. Additionally, when mining federal land outside an alluvial valley floor would materially damage the quantity or quality of water in surface or underground water systems that would supply alluvial valley floors, the land shall be considered unsuitable.

Analysis

The application lands are not within an alluvial valley floor, but such lands drain into the North Fork of the Gunnison River, along with both surface irrigated and potentially irrigable sites exist. However, material damage to the quality and quantity of water arising on or flowing over the proposed lease tract is not anticipated.

Criterion 20

Federal lands in a state to which is applicable a criterion (i) proposed by the state or Indian tribe located in the planning area, and (ii) adopted by rulemaking by the Secretary, shall be considered unsuitable.

Analysis

This criterion is not presently in effect in the state of Colorado.

SUMMARY

The Elk Creek Tract was determined to be suitable for coal mining following the application of Unsuitability Criteria Numbers 3, 4, 5, 6, 7, 8 10, 13 16, 17, 18 19 and 20.

Criterion Numbers 1, 2, 9, 11, 12, 14 and 15 were found to be unsuitable for mining, however, after applying the exceptions to the criterion, they were suitable for mining with the following restrictions:

Criterion 1: The lands within Section 35, T12S, R91W, and Section 32, T12S, R91W, 6th PM were proclaimed National Forest on June 6, 1905 and are within the Gunnison National Forest. These lands are considered suitable for coal mining after applying the exception to Criteria 1.

Criterion 2: There is a right-of-way for a powerline and road (COC-41183) located on the application lands managed by the BLM. The right-of-way is authorized to Oxbow and used for mining purposes. Lands involved in this right-of-way are suitable for coal leasing after applying the exceptions to the criteria.

Criterion 9: For water depletions, as part of the Mine Permit Application Package, the lessee shall furnish to the Regulatory Officer at the Office of Surface Mining an estimate of the average annual water depletion resulting from the proposed action. Consultation with the Fish and Wildlife Service may be required for any planned depletions. Conservation measures for the depletion will be determined during consultation. Conservation measures may include a one time payment, per acre-foot, to the Recovery Program at a fee to be established by the Fish and Wildlife Service. Arrangements for receiving the remitted funds from the lessee will be coordinated directly with the lessee by the Office of Surface Mining.

No surface disturbance or facilities will be located in occupied southwest willow flycatcher habitat. Prior to any planned disturbance within riparian habitats on the lease, the lessee must: 1) Survey the area of the proposed disturbance for suitable southwest willow flycatcher habitat, and survey all suitable habitat for the presence of the species. All habitat and species surveys must be in accordance with the accepted Fish and Wildlife Service protocol; 2) Provide the results of all surveys to the Fish and Wildlife Service, the Montrose District of BLM and the Paonia Ranger District or the Forest Service; 3) If suitable habitat or individuals are located in the area, consultation with the Fish and Wildlife Service will be required to determine suitable conservation measures to prevent a "take" under Section 9 of the Endangered Species Act. Conservation measures may include avoidance of the occupied habitat, establishment of a buffer zone and seasonal restriction around occupied habitat, or others developed for the specific site. In accordance with current protocol, surveys for the presence of the species are valid for only one year.

Criterion 11: With respect to bald or golden eagle nests which may be established on the Elk Creek Tract during the life of the project, the following special stipulations shall be applied:

1. No new permanent surface facilities or disturbances except subsidence shall be located within a one-quarter mile radius buffer zone around each bald or golden eagle nest site.

2. No surface ground activities will be allowed within a one-half mile radius buffer zone around each bald eagle active nest site from November 15 to July 30, and around each active golden eagle nest site from February 1 to July 15.

3. Any proposed surface facilities, disturbances or activities (as noted above) in, or adjacent to, these buffer zones will require approval from the BLM or Forest Service on a site-specific basis, after consultation with the Fish and Wildlife Service.

Criterion 12: With respect to bald or golden eagle roost sites or concentration areas which may be established on the Elk Creek Tract during the life of the project, the following special stipulation shall be applied:

1. No surface ground activity except subsidence shall occur within a one-quarter mile radius of winter roosts between November 15 and March 15, development may be permitted at other periods. If periodic visits are required within the buffer zone after development, activity should be restricted to the hours of 10:00 a.m. and 2:00 p.m. from November 15 through March 15.

Criterion 14: Riparian zones are present within the Elk Creek Tract and are suitable for coal leasing only with inclusion of the following special stipulations to protect resident and migratory bird species:

1. A one-eighth mile buffer zone (660 feet) will be protected on either side of riparian zones (or a buffer zone may be established in accordance with the surface management agency guidelines). No surface disturbances, except surface subsidence, will be permitted within these buffer zones, unless no practical alternatives exist. All unavoidable surface disturbance will require approval of the Forest Service or BLM Authorized Officer. The BLM or Forest Service will coordinate with the Fish and Wildlife Service and the Colorado Division of Wildlife to determine the type and extent of allowable variances. A site specific analyses will determine if this stipulation will apply.

2. With respect to other raptors (except American kestrel) which may occur or become established on the Elk Creek Tract during the life of the project, the following special stipulation shall apply:

   Conduct surveys for nesting raptors on the lease tract prior to development of any surface facilities. No surface activities will be allowed within a one-half mile radius of active nest sites between the dates of February 1 and August 15, unless authorized by the BLM or Forest Service on a site specific basis.

Criterion 15: If areas are determined by the Colorado Division of Wildlife to be mule deer and elk crucial winter range, and for the protection of migration corridors for elk, the following stipulation shall be applied:

> Coal related facilities and surface disturbances except subsidence will be authorized in the Elk Creek Tract only if no practical alternatives exist. The BLM and Forest Service will coordinate with the Colorado Division of Wildlife to determine the type and extent of allowable variances. Coal exploration, facility construction, and major scheduled maintenance will not be authorized within these crucial winter ranges from December 1 through April 30. All unavoidable surface disturbances within these crucial winter ranges during these times will require approval of the Authorized Officer. No surface facilities may be constructed in the stream/riparian corridors on the lease tract within a one-

eighth mile buffer zone on either side of Hubbard Creek, Bear Creek, or Elk Creek, in order to protect migration corridors. Surface disturbance within the one-eighth mile riparian buffer zone will not take place from December 1 through April 30.

REFERENCES

Bureau of Land Management, Various dates, unpublished Wildlife Inventories and Observations, Uncompahgre Basin Resource Area. Montrose, Colorado.

Colorado State Statutes, 1988. Division of Wildlife and Division of Parks and Outdoor Recreation, Title 33, Chapter 10, Article 11 and 111.

Federal Register, 1990. Vol. 59. No. 54, U.S. Department of the Interior, Fish and Wildlife Service, Washington DC.

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Federal Register 1991, Vol. No. ,U.S. Department of the Interior, Fish and Wildlife Service, Washington DC.

U.S. Department of the Interior, 1983. Uinta-Southwestern Utah Coal Region Environmental Impact Statement, U.S. Department of the Interior, Bureau of Land Management, Utah State Office, Salt Lake City, Utah.

U.S. Fish and Wildlife Service, 1992. Informal Section 7 Consultation, Western Colorado Suboffice, Grand Junction, CO.

CONSULTATION AND COORDINATION

The following agencies and organizations were contacted to gain information pertinent to the application of the twenty coal suitability criteria:

Federal Agencies

U.S. Department of the Interior
Fish and Wildlife Service

U.S. Department of the Interior
Office of Surface Mining

Colorado State Agencies

Division of Wildlife, Southwest Region Office, Montrose, CO
Colorado Division of Minerals and Geology

County Agencies

Delta County Planning Department
Gunnison County Planning Department

Appendix E

Mining Economics

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The evaluation of a coal mining project is a complex and detailed activity. It involves the interaction of mining engineering with finance and economics in the analysis of whether a coal mine is economically viable to shareholders and investors.

Mine evaluation involves the assessment of a variety of factors and variables that are essential in establishing the worth of the coal mining project. In determining the economic viability of a coal mining project, estimates of coal reserves, mining rates, revenues, costs, expected returns, and associated risks must be made.

The mine evaluation procedure is iterative in nature. The estimated coal reserves, as established from an exploration program, are the starting point in determining mine size and production. In turn, mine size affects production cost (both capital and operating expenses), as economics of scale are typically enjoyed with larger production rates. Ultimately, project production costs determine the amount of coal that can be mined at a profit and therefore determines the magnitude of the annual production rate.

It is important to remember that each time a variable changes in the mine evaluation procedure, the impact of this change on the other variables must be assessed, as well as the effect on subsequent financial and economic results. The iterative procedure will be repeated to determine the most economic design. This is a time-consuming process.

Further, it is important to remember that coal can be mined only when it is sold, usually under a contract with an electric utility. In the metal mining business (e.g., gold, copper), a diverse market exists in response to the supply and demand conditions. Consequently, if the metal can be mined, it can be readily sold. In the coal mine business, the market is more constrained. Generally the coal is only sold when the coal producer (the mining company) and the end user (often an electric utility) can negotiate a sale. This sale is usually on a contract basis. This fact leads the coal mine planners to make assumptions and predictions regarding the range of production that might occur.

The investment environment associated with the coal mining industry, is unique when compared to most other industries. The following describes some of the special features associated with the economics of the coal mining industry.

1.0 CAPITAL INTENSITY

Coal mining ventures are extremely capital intensive, especially underground coal mining operations which utilize longwall technology. Even small coal mining operations that require a limited workforce may require multi-million dollar investments.

2.0 COST STRUCTURE

The total average cost of coal mine production includes a high fixed-cost component that primarily reflects capital cost recovery. For this reason, the break-even production level for coal mining operations is closer to capacity than for other types of industrial operations with lower fixed costs. This is the major reason that coal mine operations run at or near capacity, often employing seven-day per week work schedules.

3.0 LONG PRE-PRODUCTION PERIODS

Even after the occurrence of a coal reserve has been established, several years of intensive effort can be required to develop the operation. The pre-production period depends on the coal mining and handling methods, size and location of the deposit, and the complexity of the regulatory framework.

The importance of long lead times is amplified when considered in conjunction with the capital intensive nature of the coal mining industry. Not only are coal companies committing extremely large capital resources to a new or expanded mining venture, but they are also exposed financially for a certain period prior to project start up. Also, since capital expenditures are required throughout the pre-production period, the longer the lead time, the greater are the returns required to offset the lost investment opportunities represented by the pre-production period. In the case of longwall operations, development must be undertaken in order to establish or "block out" the panels required for longwall operations. See *Appendix F, Overview of Underground Coal Mining.*

4.0 NON-RENEWABLE RESOURCES

Unlike most other industries, one unique aspect of the coal mining industry is the extraction of a non-renewable resource. Mining revenues result from the "disposal" of the project's main asset, the coal reserve. As a result, the return of and return on the capital investment must be obtained within the finite life of the coal reserve block.

5.0 RISK

Besides the risks associated with capital intensity and long pre-production periods, mining operations are subject to economic or market risks, geologic and engineering risks, and political and regulatory risks.

Economic or market risks are typically outside the control of the operation; these include fluxuating coal prices, inflation, lack of long-term coal contracts, and generally unpredictable future economic conditions.

Technical risks (geologic and engineering) have been notably reduced in recent years with improvement in planning methods and tools.

Often underestimated, political and regulatory risks have been increasingly important in recent years when considering coal mining investments. There is an accelerating trend to greater political participation and regulatory oversight in coal mining projects.

6.0 COAL MARKETS

Coal markets are volatile. In the 1970s, coal customers often signed up for lengthy long-term contracts (15 to 20 years). However, the current trend with coal contracts involves relatively short contracts (1 to 5 years). In addition, there are literally thousands of factors that effect coal markets and prices. Some are economic, like traditional supply and demand theories; others are political, such as decisions made by federal, state, and local governments with regard to taxation and regulation. Even the most experienced and sophisticated observer of coal markets is likely to err in predicting the future course of coal demand and prices.

Appendix F

Overview of Underground Coal Mining

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LIST OF FIGURES

(See EIS Figure Volume)

1.0 INTRODUCTION

Coal mining involves the extraction of coal deposits. Although the thickness of a coalbed may vary, minable deposits generally are continuous over large areas. When the deposit is close to the ground surface (less than 200 feet deep), it is generally mined using surface methods. Deeper deposits are generally mined by underground methods.

Geologic strata above and below the coal deposit are known as overburden and underburden, respectively. The overburden and underburden strata that are actually in contact with coal in an underground mine are called the "roof" and "floor," respectively. Blocks of coal left in place to help support the roof of the underground mine are called "pillars."

Removal of coal by underground methods creates a void in the stratigraphic column. As a block of coal is extracted, natural forces act on the stability of the overburden and cause the column to subside. Even in the strongest formations, large, artificial underground openings will eventually be filled by the collapse and compaction of overburden and pillars. Underground coal mining methods are generally classified or distinguished from each other by the type of support used to prevent the roof from collapsing prematurely on workers and equipment.

2.0 ROOM-AND-PILLAR MINING OPERATIONS

Room-and-pillar mining is a type of underground extraction used in near horizontal coal deposits where the roof is supported primarily by pillars. Coal is extracted from rectangular shaped rooms, or entries, in the coal seam. Parts of the coal seam are left between the entries and serve as pillars to support the roof. The pillars are arranged in a regular pattern, or grid, to simplify planning and operation. Pillars can be of any shape but are usually square or rectangular. The dimensions of the rooms and pillars depend on many design factors, including the stability of the roof, the strength of the coal in the pillars, the thickness of the coal seam, and the depth of mining.

Typically, coal seams mined by underground techniques in the United States range in thickness from 2.5 to 15 feet. For roof control and safety reasons, the width of the rooms, or entries is generally limited to 20 feet. The spacing, or centers, between entries varies from 40 to 100 feet depending on the stress distributions determined in the design and operation of the mine. Spacing between crosscuts is limited by ventilation concerns and is usually specified by federal and/or state safety laws (approximately 100 feet). A general representation of room-and-pillar mining is shown in *Figure F-1, Conceptual Room and Pillar Mining.*

In underground coal operations, there are two types of room-and-pillar mining:

- Conventional room-and-pillar mining
- Continuous room-and-pillar mining

Conventional mining involves a cyclical system of extraction, employing mobile equipment to conduct the production cycle of operations as follows:

- Undercut coal face
- Load holes with explosives
- Blast
- Load coal
- Roof bolt

In continuous room-and-pillar mining, the separate unit operations of conventional mining are eliminated and performed by a high-performance continuous-mining machine. In the United States, most room-and-pillar mining is conducted using a continuous-miner system which includes:

- A coal extraction machine (continuous miner).
- A coal haulage system (shuttle cars and conveyor belts).
- A roof support system (roof bolts and pillars).

The continuous miner is electrohydraulically powered and track-propelled. Major components of this machine include a rotating-cutting drum, a gathering head beneath the cutting drum, and an internal conveyor. The machine operator drives the rotating-cutting drum which is situated at the front (head) of the machine into the coalbed and cuts coal from the coal face. The gathering head which is located beneath the rotating cutting drum shifts the cut coal to the conveyor for transfer to the rear (tail) of the machine. A rear, articulating conveyor then transfers the coal to independently-operated shuttle cars.

Shuttle cars (10 to 15 tons per car) are used to transport mined coal from the continuous miner to a conveyor belt transfer point within the mine. Shuttle cars are either electric- or diesel- powered, 2- or 4-wheel drive, and have either a conveyor or push-ram system to discharge the coal to the stationary conveyor belt which transports coal outside the mine portal, usually to a run-of-mine (ROM) coal stockpile.

Pillars and roof bolts are used to support the roof. Solid pillars of coal are left in place during the initial (advance) mining stage to provide basic roof support within each block of mined-out coal and along the main access corridors (entries) of the mine. Additional roof support is provided by the use of roof bolts. Roof bolts are long steel rods, drilled into place and then anchored to the roof rock by either a resin glue or a mechanical compression device. They create a supporting “beam” of rock by bonding or “bolting” several layers of rock strata together. The general mining/production sequence allows for the continuous miner to advance about 20 feet before the roof of the mined area is secured with roof bolts. Several continuous-miner sections (entries) are developed concurrently to allow for uninterrupted mining activity (i.e., while roof bolts are being installed in some entries, mining can continue in other entries), for safety, and for ventilation.

As a general rule, 30 to 60 percent of the coal remains in place in the form of pillars after the rooms are mined. To increase coal recovery, the roof can be temporarily reinforced with additional bolts so that those pillars not required for support of the main entries can be systematically removed. In this second stage of mining, pillars are removed (or “robbed”) as the mining equipment “retreats” from each mined room. As pillar-robbing progresses, each mined-out block of rooms is allowed to cave in, and the mined area is abandoned.

3.0 LONGWALL MINING OPERATIONS

Longwall mining is an underground extraction method in fairly flat-lying, tabular coal deposits. A “long” face is established across a panel, which is blocked out on both sides by entries. These entries are known as the “headgate” entry and the “tailgate” entry. The headgate entry is used for the passage of intake air and the transportation of coal, personnel, and supplies, while the tailgate entry is used for the passage of the return air. A general representation of longwall mining is shown in *Figure F-2, Conceptual Longwall Mining*.

The longwall panel layout is simple and conducive to good ventilation, and crews always work under protective supported roof. Since the longwall system with caving leaves lesser amounts of residual pillars than other mining methods, coal recovery is higher. Depth of overburden for a longwall operation can vary from 200 to over 2,500 feet, with coal seam thickness ranging from 4 to 15 feet.

Panel width and panel length are usually determined by experience, based on the size and shape of the coal deposit, geologic conditions, and the capacities of the transportation, ventilation, and power equipment that can be supplied. In the United States, the panel width typically ranges from 500 to 1,000 feet; panel length also varies, ranging from 3,000 to 15,000 feet.

While the width of the panel face, or wall, is measured in hundreds of feet, the actual working area is narrow, measured in feet. A longwall system is kept open, by a series of heavy-duty, electrohydraulically powered, yielding supports that form a cantilever or umbrella of protection over the face. As a cut, or slice, is taken along the panel face, the supports retract, advance and re-engage, allowing the roof to cave in the mined-out area behind the supports. The caved material is known as "gob."

A very old method, longwall mining originated in European coal mines in the seventeenth century and has widespread use in coal-producing countries outside the United States. Only since the 1960s, when self-advancing, hydraulic support systems were perfected, has longwall mining been accepted in the United States. Other innovations that have led to its growing use in coal fields are the development of mobile, flexible, armored conveyors, high-speed continuous mining machines (shearers), and roof control and caving practices grounded in sound rock mechanics principles.

Longwall mining operations in the United States is predominantly of the "retreating" type. That is, the headgate and tailgate entries are developed, and the longwall mining system "retreats" from the back of the panel toward main entries. See *Figure F-3, Typical Longwall Panel Layout in the United States.* Longwall development is strikingly similar to the development for room-and-pillar mining.

Longwall operations in the United States are conducted with a longwall mining system. As with the continuous miner, the longwall system will include:

- A coal extraction machine (shearer).
- A coal haulage system (face conveyor).
- A roof support system (shields).

Whereas the continuous-mining system involves several independently operated pieces of equipment to mine coal, the longwall mining system is totally integrated, with all of the necessary equipment interconnected. For example, the longwall mining system, the shearer actually moves along the face conveyor and the shields are physically connected to it.

The shearer, like the continuous miner, is electrohydraulically powered. The major components of this machine are the rotating-cutting drums and the tram system. The drums, located at each side of the machine, are limited to an up-down movement. The machine operator drives the rotating-cutting drums into the coalbed as the machine trams laterally along the face conveyor, thereby cutting coal from the coal face. Cut coal falls to the floor-supported face conveyor for transport to the end of the longwall, the "headgate." There, the coal is transferred to another conveyor belt that transports the coal outside the mine portal. The end of the conveyor opposite the headgate is known as the "tailgate."

Longwall roof support is temporarily provided by the use of hydraulic roof supports (shields). Major components of the shields include canopy, hydraulic cylinder, hydraulic controls, and the base. The canopy is a thick, reinforced-steel plate that is pushed against the roof by hydraulic cylinders to support the weight of the overburden while coal removal operations continue below. Shields are generally 5 feet wide, vary from 4 to 15 feet high, and have a design-load capacity of 500 tons or more per shield. The base length of the shield is relatively short, allowing the face conveyor to sit on the floor in front of the base. Shields are designed to be large enough to safely cover the face conveyor, shearer, and workers. In the longwall system, individual shields are installed next to each other along the entire

longwall face, from the face conveyor headgate to its tailgate. See *Figure F-2, Conceptual Longwall Mining*.

The mining/production sequence involves cutting (shearing) a section of coal face, typically 30 to 42 inches deep, from the headgate to the tailgate, using hydraulic rams to move the face conveyor up against the face of the fresh-cut coal seam. Hydraulic rams attached to the face conveyor then move individual shields forward. The unsupported roof behind the shields is allowed to cave to the floor. As the block of coal is systematically removed, the mined area is gradually abandoned.

4.0 MECHANISMS OF SUBSIDENCE

Removal of coal deposits by underground mining methods creates voids that are filled when natural forces weaken the overburden and it collapses. The collapse of overburden into the void and the translation of this movement to the surface are known as subsidence. Subsidence-related deformation of rocks above underground mines can consist of fragmentation, fracturing, sagging, and bedding-plane separation. However, caving of the overburden into mined areas does not always translate into surface subsidence. The type of deformation that occurs, and whether the deformation reaches the surface, depends on a number of factors, including rock type, rock strength, mine layout, mine depth, and how far a particular horizon lies above the void in the mined area. The magnitude, extent, and duration of subsidence can be minimized by an efficient mine layout, proper barrier and pillar design, and a rapid and efficient mining system.

4.1 Subsidence-Related Deformation

In the overburden above mined areas, three zones of deformation tend to develop in response to subsidence, as shown on *Figure F-4, Conceptual Representation of Subsidence Deformation Zones*. In the fragmented zone, rocks of the immediate roof are expected to fragment, cave, and rotate. This zone can be as much as ten times thicker than the void produced by mining (the mining height). Directly above, in the fractured zone, rocks are expected to fracture and deform, but they should maintain their continuity. Bedding-plane separations can occur. This zone can be as much as 50 times thicker than mining height. In the third zone, the deformation zone (which some scientists separate into two zones) rocks should sag downward without major fracturing, but bedding-plane separations and surface tension cracks can still occur. This zone can extend from the top of the fractured zone to the ground surface. After the deformation process, fractures that developed in the softer sandstones and shales tend to close, while fractures that developed in more brittle rocks may remain open.

If deformation reaches the surface, subsidence will typically appear as basins or depressions, pits, and/or cracks. Subsidence basins can form above room-and-pillar mines where the pillars have been robbed or above longwall mines. These basins are typically elliptical or trough-shaped because the rooms or panels are large and rectangular, and coal seams often are nearly horizontal. Subsidence pits can form above room-and-pillar mines where the pillars have been retained because the overburden directly above the pillars continues to be supported, while the overburden above the mined area collapses into the mined-out rooms.

Horizontal strain, both tensile and compressive, results from lowering of the surface during subsidence. Tension that can cause cracks occurs as the surface begins to subside and stretch. Compression takes over and closes some of the tension cracks as the ground begins to settle. Corresponding changes in surface slope generally are temporary and commonly have a magnitude of less than 3 degrees. Tension cracks are more apparent than compression features because rocks are stronger in compression. Tension cracks are more abundant in solid rock than they are in unconsolidated materials. At the surface, tension cracks can range from small (less than an inch), subtle features that are difficult to recognize to fractures that are several feet wide and several feet deep. Surface

fractures may be temporary, with many closing during successive subsidence events, after natural deposition of sediment, or when frost heaving fills them. Tension cracks over the edges of the mined area (the mining boundaries) may remain open indefinitely. This is most evident in areas where brittle sandstones or other rocks crop out. The surface soil cover will have an influence on the cracking that is actually visible at the surface. Unconsolidated deposits of alluvium, colluvium, and soil tend to obscure surface cracks.

4.2 Factors Controlling Subsidence

Several factors control the area, amount, rate and duration of subsidence. Mining factors include mine geometry, extraction ratio, mining method, height of the mine workings, and mining rate. Geologic factors include thickness of the coal deposit, along with the thickness, lithology, strength, structure, and bulking (or swell) factor of the overburden. The subsidence factor and the angle of draw are used to describe the maximum vertical displacement and the areal extent of subsidence, respectively.

The mine geometry (or mine design) determines the size and configuration of the rooms, pillars, and panels; the height of the openings and pillars; and the spatial relation to any abandoned mines that may be located above the active mine. Generally, mines are designed so that the subsidence process can take advantage of joints in the overburden. This can minimize sagging of the immediate roof and promote rapid roof collapse. Although subsidence can be reduced by leaving pillars for support, this procedure may only delay subsidence because pillars and roof rocks generally yield with time and weathering.

The extraction ratio is the ratio of the amount of coal extracted to the total amount of coal in the deposit. Longwall mining, because it extracts nearly 100 percent of the coal within a longwall panel, generally achieves an overall extraction ratio in excess of 80 percent of the total coal deposit. Room-and-pillar mining rarely extracts more than 55 percent of the total resource, but pillar robbing upon retreat from a mine has the potential to extract nearly as much of the coal as does longwall mining.

The mining method also influences the amount of subsidence. Longwall mining results in more subsidence than room-and-pillar mining, principally because of its greater extraction of coal. Efficient robbing of pillars, however, can result in surface subsidence nearly equal in magnitude to that associated with longwall mining. Subsidence above room-and-pillar mining areas is also less predictable and more variable in surface expression than above longwall panels because the extraction ratios and heights of caving are more variable.

The mining rate affects subsidence, too. When the mine face is extracted at an even and rapid rate, smoother subsidence profiles occur with less differential movement.

Thickness of the coal deposit, thickness of the overburden, and height of the mine workings control maximum subsidence. The subsidence factor is the ratio of maximum surface subsidence to the seam mining height and is often expressed as a percentage. For example, if 7 feet of subsidence occurred over a mine with a 10-foot mining height, then the subsidence factor would be 70 percent. In the western United States, subsidence factors range from about 45 to 90 percent of the thickness of coal. The angle of draw identifies the limits of subsidence beyond the boundaries of the mined area (the areal extent of subsidence occurring at the ground surface will be larger than the underground void). It is expressed in degrees from vertical above the edge of the mined area. For example, if the angle of draw were 20 degrees and the overburden were 500 feet thick, then subsidence could occur as much as 182 feet beyond the edge of the mined area. In the western United States, subsidence angles of draw range from about 5 to 30 degrees.

Sagging, caving, and fragmentation are governed by the strength and structure of the overburden. The composition of the mineral grains and the cements that bind the grains together affect the strength of

the rocks. Existing faults and fractures in the overburden offer good sliding surfaces that can influence the angle of draw. The strength and structure of the overburden rocks are considered when determining room, pillar, and panel orientation.

The bulking factor, or the volumetric increase of fragmented rocks relative to their undisturbed and in-place volume, is a major factor influencing subsidence. The bulking factor is determined by the size and shape of the broken rocks, the contact stresses among rock fragments within the fragmented zone, and the relative strengths of the affected rocks. Bulking factors generally are lowest where the overburden is composed of soft claystones and thinly bedded shales, and greatest where hard, thickly bedded to massive sandstones and limestones predominate. If rock fragments randomly fall to the floor of the mined area, and if strong, massive rocks occur in the fractured and deformation zones, then the bulking factor is higher. Higher bulking factors in the overburden result in less vertical movement of the rocks and in reduced tension and compression at the surface.

4.3 Prediction of Subsidence

Subsidence associated with underground mining is anticipated, and its magnitude and extent can be predicted. Often, predictions of maximum surface subsidence and horizontal tensile and compressive strains are used to help assess the secondary impacts to other resources (both human and natural). Data collected during actual subsidence are used to verify prefixing predictions.

A method of calculation developed by the British National Coal Board offers one of the most comprehensive, conservative, and accurate techniques for predicting subsidence and surface strains. Other researchers have modified it for the stronger strata of coal mines in the 2estern United States. Inputs to the subsidence prediction model are depth, mining height (seam thickness), and room or panel geometry.

Subsidence profiles can be used to illustrate subsidence and strain predictions above a mined area. Diagrams A, B, and C of *Figure F-5, Example of Subsidence and Strain Profiles*, shows a cross-section of a longwall mine and the subsidence and strain profile that might be expected to develop over two mined-out longwall panels. In this example, the longwall panels are 800 feet wide, overburden is about 780 feet thick, mining height is 13.5 feet, the subsidence factor is 70 percent, and angle of draw is 22.5 degrees. Under these conditions, the maximum final surface subsidence would be 9.8 feet, which would occur over the middle of each panel. Final subsidence over the pillars between two panels, while not reaching the maximum, would still be about 5 feet.

In diagram B, the dashed line indicates the limit of subsidence resulting from a single panel, and the upper solid line represents the extent of subsidence (about 25 feet) immediately after mining the adjacent panel. The lower solid line represents the maximum final subsidence over the pillars after they have collapsed under the weight of the overburden.

Diagram C shows the compressional strain that occurs above the panels and the tensile strain that occurs at panel boundaries and over pillars as the strata flex and stretch downward into the subsidence trough. In this example, the tensile strain exceeds the strain criterion in areas above the panel boundaries and the pillars; surface cracking would be predicted in these areas, with larger maximum tensile strains possibly resulting in wider cracks. The exact location and actual width of open surface cracks is unpredictable.

A monitoring program is generally implemented at underground mines to collect subsidence data. These data are used to verify the accuracy of the predicted subsidence under actual ground conditions and to detect mining induced impacts to surface resources, both predicted and unpredicted. In addition, site-specific angle of draw, subsidence factor, and tensile strains may be calculated.

A number of techniques and types of equipment can be used in subsidence monitoring programs: conventional ground surveying of monuments located over panels and extending out over unmined areas; installation of extensometers to measure horizontal strain; serial photographic surveying; analytical aerial triangulation; digital terrain modeling; surface observations; as well as surface water and spring monitoring. To be effective, monuments must be constructed so they are unaffected by movements unrelated to subsidence, such as soil heave due to freezing.

4.4 The Subsidence Event

Subsidence, when load of the overburden is high compared with the rock strengths (that is, when the mined seam is fairly deep), may be summarized as follows:

- Sufficient coal is removed to open up the mine void, and the roof support system is withdrawn or advanced. The immediate roof is fragmented and "bulks" into the mined area, and a percentage of the mining height (i.e., the subsidence factor) subsides all the way to the surface. The surface sags downward behind the advancing front of the longwall mining activity or the retreat (when pillars are robbed) in room-and-pillar mining activity. The subsidence trough formed at the surface (controlled by the angle of draw) is wider than the mined areas.

- The advance of the longwall mining activity or the retreat (when pillars are robbed) in room-and-pillar mining activity also extends the deformation in the overburden. As the overburden rocks bend into the subsidence trough, new ground is placed in tension and new fractures open up. As the mining face passes under and progresses away from a particular point, the area of tensile stress moves away as well. Settling, accompanied by compression, takes over behind the area of stress, and the tensional fractures tend to close. As successive areas are mined, this activity takes the form of a smooth subsidence wave. Pillars collapse under the overburden load when panels or rooms are mined on both sides of those pillars. This collapse can help smooth out surface irregularities and close some of the remaining surface cracks. Massive sandstones in the overburden can also assist in smoothing out irregularities when they act as "beams" and produce a more complete collapse of pillars.

- Subsidence movement over longwall mines and over room-and-pillar mines where pillars have been robbed tends to be relatively short-lived. Ninety to ninty-five percent of the subsidence is expected to occur once coal extraction in an area is complete. Residual subsidence should occur within 2 to 5 years after mining has ceased. Some delayed subsidence may occur over pillars that deteriorate slowly.

- Subsidence movement is much slower over room-and-pillar mines where pillars have been left behind, depending on the design and height of the pillars and how much overburden weight rests on each pillar. Eventually, even the strongest pillar will deteriorate and collapse.

Where a mined area is fairly shallow and massive sandstones in the roof provide some support to the overburden load, subsidence can occur abruptly with the entire load falling as a unit. Here, the surface expression may not be as smooth as that previously described, and larger cracks could result.

Appendix G

Historic Coal Mining Activity

INTRODUCTION

Coal was discovered in the North Fork of the Gunnison River Valley in the early 1880s. Commercial coal mining on a large scale in the region began near Somerset at the Utah Fuel Corporation Somerset Mine in 1903. The Denver and Rio Grande Western Railroad constructed a railroad to service this Utah Fuel operation. The area around Somerset became one of Colorado's most important coal producing regions on the western slope. The location of the historic mining operations and the extent of their coal extraction is shown on *Figure 3, Historic Coal Mines and Federal Coal Lease Locations*, found in the attached volume of EIS figures.

For the past 100 years, numerous coal mining operations have been developed and operated in the valley. Some operations were small, operating only during the winter, with miners working the orchards during the summer. Other operations were large, on a relative scale for their day.

Utah Fuel Corporation (later U.S. Steel) shipped their coal to Utah for use as coke in the steel making process in steel mills. Other coal produced from the mines in the region was used for domestic heating in local western slope towns and communities. Still, other coal production has been shipped to electric utilities, cement plants, and miscellaneous industrial users.

The steady expansion of population in the Somerset and Paonia area because of the coal mining activities also created a local market for agricultural products. Also the railroad, constructed to ship coal, brought ranchers and farmers into contact with distant markets. Along with coal mining, the main economic base of the area during the century has been ranching and farming.

Coal mining in the valley always has been influenced by markets and coal prices. In the 1980s, coal prices showed weakness and many of the mines closed or curtailed operations. In recent years, although coal prices remain relatively low, there has been increased interest in the coal in the North Fork of the Gunnison River Valley as a "clean-compliance" coal for electric power generation. This use is attributed to its high BTU and low sulphur content.

This appendix provides an overview of historic mining operations located in the North Fork of the Gunnison River Valley. Most of the information on these mines was obtained from the files of the Colorado Division of Minerals and Geology.

Bear No. 1, No. 2, and No. 3 Mines

Tony Bear opened the Bear No. 1 Mine in 1932. The Bear No. 1 Mine is located in the SW¼, SE¼, Section 9, T13S, R90W. The Bear No. 2 portals were opened approximately 1,000 feet west of the Bear No. 1 portal. The Bear No. 1 and No. 2 mines operated in the B and C seams, and from 1932 until their closure in 1980, these operations produced a total of 3,814,164 tons or an average of 100,374 tons per year. Coal production from the Bear No. 1 and No. 2 mines varied from early pick and shovel operations with a production of only 1,283 tons in 1932 to a high production output of 250,152 tons in 1979.

Using continuous room-and-pillar mining techniques, from 1968 to 1980, the Bear No. 1 and No. 2 mines produced 2,188,873 tons of coal, or an average of 182,406 tons. In 1981, the portals were sealed, surface facilities removed, and the area regraded and seeded. At the same time, Bear Coal Company purchased the old Edwards mining property and developed the Bear No. 3 Mine. The portals for the Bear No. 3 Mine were located in the SE¼, SE¼, Section 8, T13S, R90W. The Bear No. 3 Mine operated from 1981 through 1996 producing a total of 2,136,345 tons, for an annual average production of 213,635 tons. The Bear No. 3 Mine was closed in 1996, the portals were sealed, and reclamation at the site began.

A unique historical aspect of the Bear No. 1, No. 2, and No. 3 mines is the fact that they were run by a single family operation, the Bear Coal Company, originally Tony and Virginia Bear, and later their son William Bear. Four generations of the Bear family worked at these operations.

Blue Ribbon Mine

The old Blue Ribbon Mine operated from 1952 until 1963 and was located in the NE¼, NW¼, Section 2, T13S, R91W. During that time, the mine produced only 35,805 tons, or an average of approximately 3,255 tons per year. The mine produced coal for local markets using a conventional "cut and shoot" method. The old Blue Ribbon Mine produced from the E seam or the "Hawk's Nest" seam.

The modern day Blue Ribbon Mine was located immediately adjacent to the old Blue Ribbon Mine. It operated from 1977 through 1985. During that time, the mine produced 922,858 tons, or an average of 115,357 tons per year. The mine was closed and reclaimed in 1986. The mine produced coal with modern continuous miners. Coal was transported from the face with electric shuttle cars. Belt conveyors were used to transport the coal to the surface. Electric power was supplied to the mine by on-site diesel generators. Like its predecessor, the mine produced from the E seam or "Hawk's Nest" seam.

Bowie No. 1 Mine and Coal Loadout

The Bowie No. 1 Mine and the Bowie No. 1 Coal Loadout were originally developed and operated by Colorado Westmoreland Inc. as the Orchard Valley Mine and Loadout. In 1994, these facilities were sold to Cyprus Coal Company who operated the mine until 1997, whereupon it was sold to Bowie Resources, Ltd. The Bowie No. 1 Mine is presently idle, with no coal production from this mining operation since 1996. The mine was operated as a room-and-pillar operation, and has a capacity to produce approximately 1.5 million tons of coal per year. When operating, the coal was hauled from the mine portal area to the coal loadout facility near Paonia.

The Bowie No. 1 Coal Loadout was constructed by Colorado Westmoreland Inc. This facility is presently receiving coal from the Bowie No. 2 Mine. Coal is hauled currently to the loadout with highway trucks under a contract between Bowie Resources, Ltd. and Savage Trucking, Inc. The Bowie coal loadout includes a truck dump area, conveyors, three silos with a capacity of 7,000 tons each, and a batch loadout tower for loading railroad cars.

Bowie No. 2 Mine

The old King Mine and associated facilities were purchased from Adolph Coors Company by Bowie Resources Ltd. in 1996. Bowie developed a new portal facility on the D seam, designated as the Bowie No. 2 portal. The mine presently uses room and pillar mining techniques, but plans to install a longwall system in 1999. The mine produced 1.2 million tons of coal in 1998; but, with the new longwall system, production could be increased up to 5 million tons per year. The coal removed from the Bowie No. 2 Mine is presently loaded on trucks and hauled to the Bowie No. 1 Loadout. The Bowie No. 2 portals are located in the SW¼, SW¼, Section 10, T13S, R91W.

Converse Mine

The old Converse Mine is located in the SW¼, NW¼, Section 24, T13S, R92W. This mine was originally opened to provide coal for local use and was operated from 1913 through 1936. The old Converse Mine produced only 15,801 tons during its life, averaging only 687 tons per year. The original mine was opened by Frank Converse and utilized pick and shovel mining methods.

The mining property remained idle until 1974, when the area was leased to Consolidated Coal Company who conducted some expansion activities on the tract. In 1976, the property was sold to Colorado Westmoreland Inc. and the Orchard Valley Mine was developed.

Edwards Mine

Underground coal mining activity south of the community of Somerset, Colorado across the North Fork of the Gunnison River began in 1934 with the opening of an underground operation owned by Mr. Clark and Mr. Blair. This mine was originally known as the Lone Pine Mine and in 1943, the mine was renamed the Edwards Mine. Coal mining from this operation continued over 30 years until the operation ceased in 1965.

The Edwards Mine production ranged from a low of 980 tons in 1935 to a high of 42,773 tons in 1945. Over its 30 year life, the mine produced a total of 381,350 tons from the B seam and 123,723 tons from the C seam, for a total combined production of 505,073 tons, or an average of approximately 15,783 tons per year. The mining site of the old Edwards Mine remained inactive from 1946 until 1981, when the property was bought by the Bear Coal Company and the Bear No. 3 Mine was developed.

The Clark Mine (Windjammer Mine) was operated by Mr. Clark and Mr. Blair from 1934 to 1942. The mine was re-designated the Edwards Mine in 1943 and was operated by George M. Edwards from 1943 through 1945. In 1945, the mine was sold to Paul R. Clark who owned the Clark Coal Company, and Mr. Clark operated the mine from 1946 through 1957. The North Fork Coal Corporation operated by B.R. Knoll and Partners, purchased the mine in 1958 and operated it until 1966, when the mine was closed.

Farmer's Mine

The Farmer's Mine was opened by Paonia area farmers in the early 1900s for use in local houses, in the schools and in a small Paonia power plant. The mine operated from 1911 until 1921 with a total production of 51,249 tons, or an average of 5,129 tons per year.

In 1959, the Emmons Brothers purchased the mine and operated it until 1965 when the local market declined. The highest production attained was approximately 25,000 tons in 1964. The upper D seam was mined by the pick and shovel method in the early years. Later, hand drilling and explosives were used. Hauling was by mules and four-horse wagon teams.

Hawk's Nest Mine

The Hawk's Nest Mine underwent an interesting evolution of operations. The first extraction of federal coal lands was by a group of ranchers for their own use in the early 1900s. They used a portal located in the NW½, SW¼, Section 12, T13S, R90W.

A small extraction of coal for ranching use went on until October 1922, when the Champion Coal Company was formed to expand the original ranchers' operation in the E seam using room-and-pillar mining methods. This expanded operation became known as the Hawk's Nest Mine.

The existing mine was subleased in 1932 by Mr. Clement Audin who continued to work the mine, purchasing the lease in 1938 and subsequently purchasing Champion Coal Company in 1942.

A second portal designated as the Hawk's Nest No. 2 Mine was developed in 1946 in the NW¼, SE¼, Section 11, T13S, R90W, in an area where roof conditions were better. The old portal and mine area, subsequently designated as the Hawk's Nest No. 1 Mine, were closed in 1947.

In 1953, Mr. Ellis Axelson opened a new mine, the Black Beauty Mine, from a portal at the E seam outcrop located in the NE¼, SE¼, Section 10, T13S, R90W. A second portal, the East Oliver portal and the associated Oliver Mine were subsequently developed approximately 1,000 feet to the west of the original portal. The Oliver Mine extracted coal from both the D and E coal seams.

Western Slope Carbon, Inc. was incorporated in 1970. The corporation purchased the Hawk's Nest No. 1 and No. 2 Mines from the Audin family and the Black Beauty Mine from Mr. Axelson. The Black Beauty Mine was then renamed Hawk's Nest No. 3. The Hawk's Nest No. 1 was closed in 1947 by the Audin family, and the Hawk's Nest No. 2 Mine was closed in 1970 due to insufficient capital. Western Slope Carbon, Inc. then renovated the Hawk's Nest No. 3 Mine. A bleeder portal was developed for ventilation.

In December 1974, Western Slope Carbon, Inc. was acquired as a wholly-owned subsidiary of Northwest Energy Company. The Hawk's Nest No. 2 portal was re-designated as the East portal, and all surface facilities were replaced and the underground workings were rehabilitated.

In the fall of 1980, a portion of the Hawk's Nest Mine was converted from conventional room-and-pillar mining to the first longwall operation in the North Fork of the Gunnison River Valley. The Hawk's Nest No. 3 portal was re-designated as the West portal, and underwent significant surface and underground renovation.

From 1966 through 1970, the Hawk's Nest mining complex produced approximately 174,144 tons of coal from the E seam, or an average of approximately 43,536 tons per year. From the period 1970 through 1983, the Hawk's Nest No. 3 Mine produced 2,623,600 tons from the E seam, or approximately 201,815 tons per year. When the Hawk's Nest No. 2 Mine was reopened and operated from 1976 through 1980, approximately 1,321,017 tons were removed from the E seam, or an average of approximately 330,254 tons per year. The idled property was purchased in the late 1980s and was to be operated as the Blue Horizon Coal Company, but never came to be.

The Hawk's Nest portal areas were reclaimed during 1990 and 1991 by the Colorado Division of Minerals and Geology after bond forfeiture. The mine portals were sealed, all surface facilities were removed, and the areas were contoured and seeded.

King Mine

The King Mine was located in Sections 3, 10 and 11, T13S, R91W, and produced coal from 1903 to 1975. The mine initially utilized a pick and shovel method of operation. The early mine plant consisted of a stable, mules, blacksmith shop, and steam plant and pump. In later years, the coal was shot and loaded with mechanized loading machines. The coal was initially hauled from the portal with wagon teams. A tramway from the mine was completed in 1907. A four-track tipple was used to load the coal onto rail cars. The mine supplied coal to a mine mouth electric power generating station from 1922 until about 1949. The power plant supplied electricity to the surrounding area. The King Mine produced from the B seam. Previous operators of the property included Jack, Alex and Wallace Bowie (1903-1917), Juanita Coal and Coke Company (1917-1974), and Adolph Coors Company (1974-1995). The mine produced a variety of tonnage ranging from a low of 1,049 tons in 1906 to a high of 103,622 tons in 1920. In total, the mine produced 2,996,248 tons or an average of approximately 41,615 tons per year. In 1995, the Adolph Coors Company sold the property to Bowie Resources, Ltd. and the Bowie No. 2 Mine was developed.

Orchard Valley Mine

The Orchard Valley Mine was opened in 1976 at the site of the old Converse Mine in the SW¼, NW¼, Section 24, T13S, R92W. The Orchard Valley Mine was owned and operated by Colorado

Westmoreland Inc. The mine produced coal from the D seam from 1976 to1993. A total of 5,726,166 tons were mined from the Orchard Valley Mine, at an average of approximately 716,021 tons per year.

Colorado Westmoreland Inc. also built a modern train loadout facility adjacent to the North Fork of the Gunnison River in portions of Sections 31, 32 and 29, T13S, R91W. This facility included a truck dump station, coal silos, and a coal train loadout, along with a spur line from the main Denver and Rio Grande Railroad line.

In June 1986, the Orchard Valley Mine was closed after a mine fire. The mine re-opened through west portals in January 1987. The property, including the mining operation and the loadout were later sold to Cyprus Coal Company in 1994, who in turn sold to Bowie Resources, Ltd. in 1996. The Orchard Valley Mine was renamed the Bowie No. 1 Mine, and the associated coal loadout facilities near Paonia became known as the Bowie No. 1 Loadout.

Sanborn Creek Mine

In 1990, the Somerset Mining Company developed and opened the new Sanborn Creek Mine in the C seam. This mine utilizes the surface facilities at the location of the old Somerset Mine. The Sanborn Creek Mine has continued operations through a series of names including: Somerset Mining Company (1990-1995), Pacific Basin Resources (1995-1996), and Oxbow Mining, Inc. (1997-present). While ownership entities appear to have changed over the period from 1990 through present, Oxbow Carbon and Minerals, Inc. has remained in ownership since the start of the mine. Mine personnel and operations have generally remained stable.

New coal handling facilities have been constructed at the Sanborn Creek Mine, along with a new shop and office complex. A new batch rail loadout has also been added to this facility.

The Sanborn Creek Mine utilizes longwall mining techniques and mined 1.5 million tons of coal in 1998. The mine was planning for a production of 4.0 million tons in 1999, but was forced to shutdown in January of 1999 when elevated CO and CO_2 were detected in the mine ventilation exhaust as the result of a fire. The mine was sealed and the mine fire area flooded with water. After working with the Mine Safety and Health Administration on safety issues and precautions, Oxbow reopened the operation in June of 1999.

The new Elk Creek Mine, with its longwall system and related conveying capacity will have the potential to produce up to 6 million tons per year of coal.

Somerset Mine

In 1902, shortly after initial coal discoveries and development in the area, the Denver and Rio Grande Railroad was extended up the North Fork of the Gunnison River Valley to Somerset.

With both the need for coal for railroad and access to other markets, the Utah Fuel Corporation constructed a company town at Somerset in 1903 and operated the Somerset Mine from portals at the C seam outcrop. In the 1920s, approximately 300 miners produced 1,200 tons of coal daily from the Somerset Mine. The Somerset Mine portals and associated surface facilities, located in the SW¼, SE¼, Section 8, T13S, R90W, occupied the area of the present Oxbow Mining, Inc. surface facilities.

The Somerset Mine was a major producer in the North Fork of the Gunnison River Valley, operating continuously through the 1980s. The mine had a series of owners including Utah Fuel Corporation (1903 through 1935), Kaiser Steel Corporation (1935 through 1946), Minerals Development Corporation (1946 through 1958), U.S. Steel Mining Company (1958 through 1985), and Kaiser Coal Company (1986 through 1990).

Ongoing expansion of the Somerset Mine and associated surface facilities included development of surface facilities along Bear Creek in the 1960s and Hubbard Creek in the 1970s and 1980s. The Somerset Mine extracted coal from the B seam under Bear Creek and under Hubbard Creek. When the Somerset Mine was shutdown at the end of 1985, mining was occurring west of Hubbard Creek in the B seam. The C seam was mined until about 1980 when U.S. Steel Corporation closed the entire Somerset operation.

There was extensive renovation and construction work at the Somerset Mine in the 1960s. This included the construction of a dump station and crusher installation in the early 1960s, followed by the construction of a coal storage silo and a new rail line in the late 1960s. Production from the Somerset Mine ceased in 1985, and the mine sat idle until 1990. At this time, the B and C seam portals were sealed.

In 1990, the Somerset Mining Company developed and opened the new Sanborn Creek Mine in the C seam. The existing surface facilities of the Somerset Mine were again utilized.

Terror Creek Loadout

A custom coal loadout, known as the Terror Creek Loadout, was constructed in 1982 by the Pacific Basin Coal and Carbon Company. The Terror Creek Loadout is located in Section 15, T13S, R91W. Originally, the Terror Creek Loadout received coal from the Bear No. 3 Mine. Presently, the loadout receives coal from the Sanborn Creek Mine. The Terror Creek Loadout is able to handle approximately 150,000 tons of coal per year. The facility is owned by Oxbow Carbon and Minerals, Inc. (88%) and the Bear Coal Company (12%). The facility is currently operated by Oxbow Carbon and Minerals, Inc.

West Elk Mine

The West Elk Mine portal facilities are located in the NW¼, Section 16, T13S, R90W. The mine, known as the Mt. Gunnison No. 1 Mine, was originally developed in 1981 by ARCO Coal Company under a subsidiary known as the West Elk Coal Company. In 1991, after a company reorganization, the operating company was renamed Mountain Coal Company and the mine name changed to the West Elk Mine. The mine was sold in 1998 to Arch Coal, Inc. Mountain Coal Company continues to operate the West Elk Mine. While ownership entities have changed, mine personnel and operations have generally remained stable.

The original mine was a room-and-pillar operation in the F coal seam, but a longwall system of operation was added in the B coal seam in 1991. In 1998, Mountain Coal Company shipped 5,900,000 tons of coal from the West Elk Mine. Projections indicate that production could be up to 7.3 million tons in the year 2000 and 8.2 million tons in the year 2005.

Appendix H

Standard BLM Coal Lease Terms, Conditions and Stipulations

Form 3400-12
(January 1995)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FORM APPROVED
OMB NO. 1004-0073
Expires: June 30, 1997

Serial Number

COAL LEASE

PART I. LEASE RIGHTS GRANTED

This lease, entered into by and between the UNITED STATES OF AMERICA, hereinafter called lessor, through the Bureau of Land Management, and *(Name and Address)*

hereinafter called lessee, is effective *(date)* , for a period of 20 years and for so long thereafter as coal is produced in commercial quantities from the leased lands, subject to readjustment of lease terms at the end of the 20th lease year and each 10-year period thereafter.

Sec. 1. This lease is issued pursuant and subject to the terms and provisions of the:

☐ Mineral Lands Leasing Act of 1920, Act of February 25, 1920, as amended, 41 Stat. 437, 30 U.S.C. 181-287, hereinafter referred to as the Act;

☐ Mineral Leasing Act for Acquired Lands, Act of August 7, 1947, 61 Stat. 913, 30 U.S.C. 351-359;

and to the regulations and formal orders of the Secretary of the Interior which are now or hereafter in force, when not inconsistent with the express and specific provisions herein.

Sec. 2. Lessor, in consideration of any bonuses, rents, and royalties to be paid, and the conditions and covenants to be observed as herein set forth, hereby grants and leases to lessee the exclusive right and privilege to drill for, mine, extract, remove, or otherwise process and dispose of the coal deposits in, upon, or under the following described lands:

containing acres, more or less, together with the right to construct such works, buildings, plants, structures, equipment and appliance[s] and the right to use such on-lease rights-of-way which may be necessary and convenient in the exercise of the rights and privileges granted, subject t[o] the conditions herein provided.

PART II. TERMS AND CONDITIONS

Sec. 1. (a) RENTAL RATE - Lessee shall pay lessor rental annually and in advance for each acre or fraction thereof during the continuance of the lease at the rate of $ for each lease year.

(b) RENTAL CREDITS - Rental shall not be credited against either production or advance royalties for any year.

Sec. 2. (a) PRODUCTION ROYALTIES - The royalty shall be per-cent of the value of the coal as set forth in the regulations. Royalties are due to lessor the final day of the month succeeding the calendar month in which the royalty obligation accrues.

(b) ADVANCE ROYALTIES - Upon request by the lessee, the authorized officer may accept, for a total of not more than 10 years, the payment of advance royalties in lieu of continued operation, consistent with the regulations. The advance royalty shall be based on a percent of the value of a minimum number of tons determined in the manner established by the advance royalty regulations in effect at the time the lessee requests approval to pay advance royalties in lieu of continued operation.

Sec. 3. BONDS - Lessee shall maintain in the proper office a lease bond in the amount of $. The authorized officer may require an increase in this amount when additional coverage is determined appropriate.

Sec. 4. DILIGENCE - This lease is subject to the conditions of diligen[t] development and continued operation, except that these conditions ar[e] excused when operations under the lease are interrupted by strikes, th[e] elements, or casualties not attributable to the lessee. The lessor, in th[e] public interest, may suspend the condition of continued operation upo[n] payment of advance royalties in accordance with the regulations i[n] existence at the time of the suspension. Lessee's failure to produce coa[l] in commercial quantities at the end of 10 years shall terminate th[e] lease. Lessee shall submit an operation and reclamation plan pursuan[t] to Section 7 of the Act not later than 3 years after lease issuance.

The lessor reserves the power to assent to or order the suspension of th[e] terms and conditions of this lease in accordance with, inter ali[a] Section 39 of the Mineral Leasing Act, 30 U.S.C. 209.

Sec. 5. LOGICAL MINING UNIT (LMU) - Either upon approval by th[e] lessor of the lessee's application or at the direction of the lessor, thi[s] lease shall become an LMU or part of an LMU, subject to the provision[s] set forth in the regulations.

The stipulations established in an LMU approval in effect at the time o[f] LMU approval will supersede the relevant inconsistent terms of th[is] lease so long as the lease remains committed to the LMU. If the LMU o[f] which this lease is a part is dissolved, the lease shall then be subject t[o] the lease terms which would have been applied if the lease had not bee[n] included in an LMU.

APPENDIX 6

Sec. 6. DOCUMENTS, EVIDENCE AND INSPECTION - At such times and in such form as lessor may prescribe, lessee shall furnish detailed statements showing the amounts and quality of all products removed and sold from the lease, the proceeds therefrom, and the amount used for production purposes or unavoidably lost.

Lessee shall keep open at all reasonable times for the inspection of any duly authorized officer of lessor, the leased premises and all surface and underground improvements, works, machinery, ore stockpiles, equipment, and all books, accounts, maps, and records relative to operations, surveys, or investigations on or under the leased lands.

Lessee shall allow lessor access to and copying of documents reasonably necessary to verify lessee compliance with terms and conditions of the lease.

While this lease remains in effect, information obtained under this section shall be closed to inspection by the public in accordance with the Freedom of Information Act (5 U.S.C. 552).

Sec. 7. DAMAGES TO PROPERTY AND CONDUCT OF OPERATIONS - Lessee shall comply at its own expense with all reasonable orders of the Secretary, respecting diligent operations, prevention of waste, and protection of other resources.

Lessee shall not conduct exploration operations, other than casual use, without an approved exploration plan. All exploration plans prior to the commencement of mining operations within an approved mining permit area shall be submitted to the authorized officer.

Lessee shall carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health, or property, and prevention of waste, damage or degradation to any land, air, water, cultural, biological, visual, and other resources, including mineral deposits and formations of mineral deposits not leased hereunder, and to other land uses or users. Lessee shall take measures deemed necessary by lessor to accomplish the intent of this lease term. Such measures may include, but are not limited to, modification to proposed siting or design of facilities, timing of operations, and specification of interim and final reclamation procedures. Lessor reserves to itself the right to lease, sell, or otherwise dispose of the surface or other mineral deposits in the lands and the right to continue existing uses and to authorize future uses upon or in the leased lands, including issuing leases for mineral deposits not covered hereunder and approving easements or rights-of-way. Lessor shall condition such uses to prevent unnecessary or unreasonable interference with rights of lessee as may be consistent with concepts of multiple use and multiple mineral development.

Sec. 8. PROTECTION OF DIVERSE INTERESTS, AND EQUAL OPPORTUNITY - Lessee shall: pay when due all taxes legally assessed and levied under the laws of the State or the United States; accord all employees complete freedom of purchase; pay all wages at lease twice each month in lawful money of the United States; maintain a safe working environment in accordance with standard industry practices; restrict the workday to not more than 8 hours in any one day for underground workers, except in emergencies; and take measures necessary to protect the health and safety of the public. No person under the age of 16 years shall be employed in any mine below the surface. To the extent that laws of the State in which the lands are situated are more restrictive than the provisions in this paragraph, then the State laws apply.

Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and the rules, regulations, and relevant orders of the Secretary of Labor. Neither lessee nor lessee's subcontractors shall maintain segregated facilities.

Sec. 9. (a) TRANSFERS

- ☐ This lease may be transferred in whole or in part to any person, association or corporation qualified to hold such lease interest.
- ☐ This lease may be transferred in whole or in part to another public body or to a person who will mine the coal on behalf of, and for the use of, the public body or to a person who for the limited purpose of creating a security interest in favor of a lender agrees to be obligated to mine the coal on behalf of the public body.
- ☐ This lease may only be transferred in whole or in part to another small business qualified under 13 CFR 121.

Transfers of record title, working or royalty interest *must* be approved in accordance with the regulations.

(b) RELINQUISHMENT - The lessee may relinquish in writing at any time all rights under this lease or any portion thereof as provided in the regulations. Upon lessor's acceptance of the relinquishment, lessee shall be relieved of all future obligations under the lease or the relinquished portion thereof, whichever is applicable.

Sec. 10. DELIVERY OF PREMISES, REMOVAL OF MACHINERY, EQUIPMENT, ETC. - At such time as all portions of this lease are returned to lessor, lessee shall deliver up to lessor the land leased, underground timbering, and such other supports and structures necessary for the preservation of the mine workings on the leased premises or deposits and place all workings in condition for suspension or abandonment. Within 180 days thereof, lessee shall remove from the premises all other structures, machinery, equipment, tools, and materials that it elects to or as required by the authorized officer. Any such structures, machinery, equipment, tools, and materials remaining on the leased lands beyond 180 days, or approved extension thereof, shall become the property of the lessor, but lessee shall either remove any or all such property or shall continue to be liable for the cost of removal and disposal in the amount actually incurred by the lessor. If the surface is owned by third parties, lessor shall waive the requirement for removal, provided the third parties do not object to such waiver. Lessee shall, prior to the termination of bond liability or at any other time when required and in accordance with all applicable laws and regulations, reclaim all lands the surface of which has been disturbed, dispose of all debris or solid waste, repair the offsite and onsite damage caused by lessee's activity or activities incidental thereto, and reclaim access roads or trails.

Sec. 11. PROCEEDINGS IN CASE OF DEFAULT - If lessee fails to comply with applicable laws, existing regulations, or the terms, conditions and stipulations of this lease, and the noncompliance continues for 30 days after written notice thereof, this lease shall be subject to cancellation by the lessor only by judicial proceedings. This provision shall not be construed to prevent the exercise by lessor of any other legal and equitable remedy, including waiver of the default. Any such remedy or waiver shall not prevent later cancellation for the same default occurring at any other time.

Sec. 12. HEIRS AND SUCCESSORS-IN-INTEREST - Each obligation of this lease shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 13. INDEMNIFICATION - Lessee shall indemnify and hold harmless the United States from any and all claims arising out of the lessee's activities and operations under this lease.

Sec. 14. SPECIAL STATUTES - This lease is subject to the Clean Water Act (33 U.S.C. 1252 et. seq.), the Clean Air Act (42 U.S.C. 4274 et. seq.), and to all other applicable laws pertaining to exploration activities, mining operations and reclamation, including the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201 et. seq.).

Sec. 15. SPECIAL STIPULATIONS -

Sec. 15. SPECIAL STIPULATIONS (Cont'd.) -

THE UNITED STATES OF AMERICA

	By
Company or Lessee Name	
(Signature of Lessee)	(Signing Officer)
(Title)	(Title)
(Date)	(Date)

Title 18 U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

This form does not constitute an information collection as defined by 44 U.S.C. 3502 and therefore does not require OMB approval.

GPO 854-476

Appendix I

Forest Service Stipulations Iron Point Coal Lease Tract and Exploration License Area

TABLE OF CONTENTS

Serial No. C-61209

CONTROLLED SURFACE USE STIPULATION
GENERAL FOREST(LEASE TRACT)

Surface occupancy or use is subject to the following special operating constraints.

Underground mining operations will result in surface subsidence. The operator/lessee shall perform a study to secure adequate baseline data to quantify the existing surface resources on and adjacent to the lease area. Existing data may be used if such data is adequate for the intended purposes. The study shall be adequate to locate, quantify, and demonstrate the inter-relationship of the geology, topography, surface hydrology, vegetation and wildlife. Baseline data will be established so that future programs of observation can be incorporated at regular intervals for comparison.

The operator/lessee shall establish a monitoring system to locate, measure and quantify the progressive and final effects of underground mining activities on the topographic surface, underground and surface hydrology and vegetation. The monitoring system shall utilize techniques which will provide a continuing record of change over time and an analytical method for location and measurement of a number of points over the lease area. The monitoring shall incorporate and be an extension of the baseline data.

Measures will be taken to insure that the Dove Cave is protected from the negative effects of subsidence and that its structural integrity is maintained. (Section 34, T12S, R91W, 6th PM)

If subsidence adversely affects surface resources, or causes a documented water loss, the operator shall:

1. Restore stream channels and surface drainage or protect stream flow with earthwork or temporary culverting; or

2. Restore affected road; or

3. Revegetate as necessary to protect against erosion; or

4. Restore or replace surface structures or compensate the owner of those surface structures; or

5. Provide other mitigation.

On lands described below:

National Forest System Lands within the entire lease.

For the purpose of:

To insure the stability of surface resources and facilities during and after the coal mining operations.

Waivers, exceptions, or modifications (WEMs) to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary

action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1650 and 2820.)

Coal-CSU-GF 2/95

(REVISED 2-28-95) Serial No. C-61209

NO SURFACE OCCUPANCY STIPULATION
WETLANDS/FLOODPLAINS/RIPARIAN AREAS (LEASE TRACT)

No surface occupancy or use is allowed on the lands defined as a Wetland, a Floodplain, or a Riparian area.

Wetlands, Floodplains and Riparian Areas are defined as:

Wetlands: A Federal Manual which defines jurisdictional wetlands was jointly developed by the U.S. Corp of Engineers, the Soil Conservation Service, the Environmental Protection Agency and the U.S. Fish and Wildlife Service. (January 1987) This definition is adopted. In general, wetlands are defined by the presence of: permanent or seasonal water; water loving vegetation; and soil characteristics influenced by saturated conditions. All three of these conditions must exist in order to qualify as a wetland. (Page III-54, Oil and Gas Leasing EIS)

Floodplains: This is a strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks. It is built of alluvium carried by the river during floods and deposited in the sluggish water outside the influence of the swiftest current. A river has only one floodplain but may have one or more terraces representing abandoned floodplains. (Page III-50, Oil and Gas Leasing EIS)

Riparian Areas: Geographically delineated areas with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems. (FSM WO 2500-94-4 pg 17) They may be associated with lakes, reservoirs, estuaries, potholes, marshes, streams, bogs, wet meadows, and intermittent or permanent streams where free and unbound water is available. (Page VII-13, Oil and Gas Leasing EIS) the riparian ecosystems are “transitional areas” between the aquatic ecosystem and the adjacent terrestrial ecosystem; identified by soil characteristics or distinctive vegetation communities, and are characterized by species and/or life forms that are different from those of the immediately surrounding non-riparian climax area. (Page III-52, Oil and Gas Leasing EIS)

The application of the definition for wetlands, floodplains, and riparian areas to ground conditions will determine whether the stipulation applies. When facilities and activities associated with coal mining must occur in these areas, impacts to these areas will be minimized and mitigated. Roads will cross streams at right angles and access across other areas subject to this stipulation will be held to a minimum. Streams will not be paralleled by roads through these areas other than to the extent necessary for crossings.

The width of adjacent upland areas which will fall under jurisdiction of this stipulation, will be dependent on slope steepness, and the kind, amount, and location of surface and vegetation disturbance. (The GMUG Amended Land and Resource management Plan, Page III-75 provides guidelines for these areas.)

Forest Development Road 842 (East Fork of Terror Creek Road) has been in existence for many years and portions of it traverses through riparian areas. The road is deemed necessary for continued public and coal operation access to the East Fork of Terror Creek area. Therefore, it is granted an exception.

For the purpose of:

The management of wetlands and floodplains are subject to Executive Orders (EO) 11990 and 11988, respectively. The purpose of the EOs are to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and floodplains and to avoid direct or indirect support of new construction in wetlands wherever there is a practical alternative.

Also, it is recognized that there is a direct relationship between impacts on such areas and effects on water quality and aquatic ecosystems. There is a high risk of irreversible and irretrievable impacts on the latter with operation and developments in wetlands, floodplains and riparian areas.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements.

Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Conditions under which a WEM could be granted:

If it can be shown through environmental analysis and the application of mitigation measures that the impacts to wetland, floodplain and riparian resources will be minimized and that no other alternative location for facilities and activities associated with coal mining is practical because of environmental effects and operational considerations (eg, economics, health and safety, etc.)

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1650 and 2820.)

Coal-NSO-WFR 2/95

(REVISED 2-28-95) Serial No. C-61209

CONTROLLED SURFACE USE STIPULATION
MODERATE GEOLOGIC HAZARDS (LEASE TRACT)

Surface occupancy or use is subject to the following special operating constraints.

Special interdisciplinary team analysis and mitigation plans detailing construction and mitigation techniques will be required on areas having moderate geologic hazards. (The interdisciplinary team could include: geotechnical engineer, soils engineer, road engineer, coal mining engineer and reclamation specialist.) Attributes constituting moderate geologic hazard include stabilized earthflows, stabilized mudflows, stabilized landslides; slopes adjacent to failed slopes or active earthflows, mudflows, or landslides and avalanche chutes; areas of rockfall; and flash flood areas.

On lands described below:

Portions of Section 33, T12S, R91W, 6th PM with moderate geologic hazards as generally delineated on a map prepared on 1-15-98 by Michael Ward. The map is for planning purposes only. The application of the definition of moderate geologic hazard to ground conditions will determine whether the stipulation applies. In the event of any conflict between written clauses of this stipulation and the map, the stipulation clauses shall control. All National Forest System Land within the leasehold which is classified as having moderate geologic hazards falls under jurisdiction of this stipulation.

For the purpose of:

To insure the stability of facilities required (such as roads, waterlines, water tanks, powerlines, ventilation shafts, ancillary buildings, drillpads, etc.) during the coal mining operations and to insure the stability of lands adjacent to these facilities.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1650 and 2820.)

Coal-CSU-MGH 2/95

(REVISED 3-9-95) Serial No. C-61209

NO SURFACE OCCUPANCY STIPULATION HIGH GEOLOGIC HAZARDS (LEASE TRACT)

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description) except when a waiver, exception, or modification (WEM) to this stipulation is granted. See WEM clause below.

Portions of Section 33, and 34, T12S, R91W, 6th PM are characterized by high geologic hazards defined as active mudflows, active earthflows, active landslides and areas prone to avalanche. Presumed areas of No Surface Occupancy are generally delineated on a map prepared by Michael K. Ward on 1-15-98. The map is for planning purposes only. The application of the definition of high geologic hazard to ground conditions will determine whether the stipulation applies. In the event of any conflict between written clauses of this stipulation and the map, the stipulation clauses shall control. All National Forest System Land within the leasehold which is classified as high geologic hazard falls under jurisdiction of this stipulation.

For the purpose of:

Avoidance of areas with high geologic hazard to prevent further mass slope failure.

It may be necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a Forest Service discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Conditions under which a WEM may be granted include the following:

1. Use of the area for a short distance or a small area.

2. Mitigation and design can minimize impacts to soil and visual resources, for example, powerlines and waterlines required through these areas shall be constructed to minimize impacts.

3. No other alternative location for facilities and activities associated with coal mining is practical because of environmental effects and operational considerations (eg, economics, health and safety, etc.).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM manual 1624 and 3400 or FS Manual 1650 and 2820.)

Coal-NSO-HGH 2/95

(REVISED 2-28-95) Serial No. C-61209

TIMING LIMITATION STIPULATION
BIG GAME WINTER RANGE (LEASE TRACT)

No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of facilities associated with coal mining.

1. Exploration, drilling and development activity will not be allowed during the period from December 1 to April 30. In the event of an emergency, surface use (including drilling) may be allowed with authorization from the Forest Service.

2. New roads on public lands will be closed yearlong to the public.

On the lands described below:

All or portions of Section 33 and 34, T12S, R91W, 6th PM with winter ranges for big game (elk) as generally delineated on a map, prepared on 1-15-98 by Michael K. Ward. The map is for planning purposes only. The existence of big game winter range on the ground will determine whether the stipulation applies. In the event of any conflict between written clauses of this stipulation and the map, the stipulation clauses shall control. All National Forest System Land within the leasehold which is classified as big game winter range for elk falls under jurisdiction of this stipulation.

For the purpose of (reasons):

Preventing unnecessary stress on the wintering wildlife herds and causing an increase in mortality resulting from disturbances and habitat losses. These areas are critical for elk during winter. They serve as key concentration areas which support and sustain this species and are extremely important for animal survival.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1950 and 2820.)

Coal-TL-BGWR 2/95

(REVISED 3-9-95) Serial No. C-61209

NO SURFACE OCCUPANCY STIPULATION
SLOPES > 60% (LEASE TRACT)

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description) except when a waiver, exception, or modification (WEM) to this stipulation is granted. See WEM clause below.

Portions of Section 33 and 34, T12S, R91W, 6th PM with slopes greater than 60%. Presumed areas of No Surface Occupancy are generally delineated on a map prepared by Michael K. Ward on 1/15/98. The map is for planning purposes only. In the event of any conflict between written clauses of this stipulation and the map, the stipulation clauses shall control. All National Forest System Land within the leasehold which has slopes greater than 60% fall under jurisdiction of this stipulation.

For the purpose of (reasons):

Protection of areas with slopes greater than 60% prevent impacts to soil resources through erosion, mass failure, loss of productivity, etc.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a Forest Service discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Conditions under which a WEM may be granted include the following:

1. Use of the surface for a short distance or a small area.

2. Mitigation and design can minimize impacts to soil and visual resources; for example, powerlines and waterlines required on slopes greater than 60% shall be constructed so as to minimize impacts.

3. No other alternative location for facilities and activities associated with coal mining is practical because of environmental effects and operational considerations (eg, economics, health and safety, etc.).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1950 and 2820.)

Coal-NSO->60% 2/95

(REVISED 2-28-95) Serial No. C-61209

CONTROLLED SURFACE USE STIPULATION SLOPES 40-60% (LEASE TRACT)

Surface occupancy or use is subject to the following special operating constraints.

Special inter-disciplinary team analysis and mitigation plans detailing construction and mitigation techniques will be required on areas with slopes ranging from 40-60%. (The interdisciplinary team could include engineering, soil scientist, hydrologist, landscape architect, reclamation specialist and coal mining engineer.)

Mitigation may include, but is not limited to, use of erosion control cloths, mats, geoweb soil support materials, lifting and saving local native vegetation in chunks of sod to be later placed over disturbed areas, reseeding disturbed banks with stabilizing seed mix, use of chemical stabilizers, tackifiers and blankets and careful design of surface water flow.

On the lands described below:

Portions of Section 33 and 34, T12S, R91W, 6th PM with slopes 40-60% as generally delineated on a map prepared on 1-15-98 by Michael Ward. The map is for planning purposes only. In the event of any conflict between written clauses of this stipulation and the map, the stipulation clauses shall control. All National Forest System Land within the leasehold which has slopes ranging from 40-60% falls under jurisdiction of this stipulation.

For the purpose of:

Minimizing potential for soil loss, mass land movement, revegetation failure and unacceptable visual impairment.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1950 and 2820.)

Coal-CSU-40-60-2/95

(REVISED 2-28-95) Serial No. C-61209

CONTROLLED SURFACE USE STIPULATION
BIG GAME WINTER RANGE (LEASE TRACT)

Surface occupancy or use is subject to the following special operating constraints.

Operation and maintenance of facilities associated with coal mining such as roads, waterlines, water tanks, powerlines, ventilation shafts, ancillary buildings, and including monitoring will be scheduled to minimize adverse effects on big game (elk) from December 1 to April 30. Unscheduled use will be allowed in emergency situations with notice and coordination with the Forest Service.

Limit road use to periods when animals are not present on the winter range. Restrict road use to personnel associated with operation and maintenance of coal mining facilities. Recontour and revegetate to prior existing conditions (to extent possible) new roads when work is complete.

On lands described below:

Portions of Section 33 and 34, T12S, R91W, 6th PM with winter range for big game (elk) as generally delineated on a map prepared on 1-15-98 by Michael K. Ward. The map is for planning purposes only. The existence of big game winter range on the ground will determine whether the stipulation applies. In the event of any conflict between written clauses of this stipulation and the map, the stipulation clauses shall control. All National Forest System Land within the leasehold which is classified as big game winter range for elk falls under jurisdiction of this stipulation.

For the purpose of:

Protecting big game winter range for elk. These ranges are extremely important for animal survival during winter. Disturbances and habitat losses may place unnecessary stress on the wintering wildlife herds and cause an increase in herd mortality.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1650 and 2820.)

Coal-CSU-WR 2/95

Serial No. C-61209

TIMING LIMITATION STIPULATION
FALL-WINTER SHUT-DOWN (LEASE TRACT)

No surface use is allowed during the following time period(s).

1. Exploration, drilling and development activity will not be allowed during the period from: October 1 through May 15, or whenever conditions in the spring are sufficiently dry to allow operations without causing surface damage. Operations between October 1 and the Friday preceding regular big game hunting season, usually around October 10, may be allowed during dry weather upon written authorization of the authorized officer.

2. New roads on public lands will be closed yearlong to the public.

On the lands described below:

Portions of Section 33 and 34, T12S, R91W, 6th PM as generally delineated on a map, prepared on 1-15-98 by Michael K. Ward. All National Forest System Land within the leasehold falls under jurisdiction of this stipulation.

For the purpose of (reasons):

1. Protecting the soil and water resource, particularly with regard to roads and other surface disturbances.

1. Provide for safety of the general public and the operator.

2. Reduce user conflict during regular big game hunting seasons.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1950 and 2820.)

Coal-TL-BGWR 2/98

Serial No. C-61209

LEASE NOTICE
INTERIM ROADS POLICY (LEASE TRACT)

Lands contained within this lease are subject to the Forest Service interim Rule, “Administration of the Forest service Development Transportation System: Temporary Suspension of Road Construction and Reconstruction in Unroaded Areas”; Federal Register/Vol. 64. No. 29/Friday, February 12, 1999, pages 7290 through 7305. These lands will also be subject to the final road management policy which will be set within 18 months.

No road construction will be allowed within the unroaded area until the Forest Service adopts its revised road management policy or 18 months from the effective date of this final interim rule, whichever is sooner.

Serial No. COC-61945

NO SURFACE OCCUPANCY STIPULATION
WETLANDS/FLOODPLAINS/RIPARIAN AREAS
(EXPLORATION LICENSE APPLICATION)

No surface occupancy or use is allowed on the lands defined as a Wetland, a Floodplain, or a Riparian area. These areas are generally shown on USGS quadrangle maps.

Wetlands, Floodplains, and Riparian Areas of any defined drainage or location containing these specific ecosystem types come under jurisdiction of this stipulation. Drill pads, staging areas and storage sites will not be allowed in these areas. When road locations must occur in these areas, streams will be crossed at right angles and access across other areas will be held to a minimum. Streams will not be paralleled by roads through these areas.

Location of these areas which is more specific than can be identified on USGS topographical maps will come at the APD stage based on on-the-ground observations.

For the purpose of:

The management of wetlands and floodplains are subject to Executive Orders (EO) 11990 and 11988, respectively. The purpose of the EO's are to avoid, to the extent possible, the long and short term adverse impacts associated with the destruction or modification of wetlands and floodplains and to avoid direct or indirect support of new construction in wetlands wherever there is a practical alternative.

Also, it is recognized that there is a direct relationship between impacts on such areas and effects on water quality and aquatic ecosystems. There is a high risk of irreversible and irretrievable impacts on the latter with operation and developments in wetlands, floodplains and riparian areas.

Waivers, exceptions, or modifications (WEM's) to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

NSO-WFR 4/97

Serial No. COC-61945

CONTROLLED SURFACE USE STIPULATION
MODERATE GEOLOGIC HAZARDS
(EXPLORATION LICENSE APPLICATION)

Surface occupancy or use is subject to the following special operating constraints.

Special interdisciplinary team analysis and mitigation plans detailing construction and mitigation techniques will be required on areas having moderate geologic hazards. (Interdisciplinary team disciplines could include: geotechnical engineer, soils engineer, roads engineer, oil and gas specialist and reclamation specialist.) Attributes constituting moderate geologic hazard include stabilized earthflows, stabilized mudflows or landslides and avalanche chutes; areas of rockfall; flash flood zones; and areas with potential mining related problems (i.e., subsidence, acid drainage). Any area within the leasehold which is identified as having moderate geologic hazard falls under jurisdiction of this stipulation.

For the purpose of:

To insure the stability of facilities required (roads, pipelines, drillpads, etc.) and to insure the stability of lands adjacent to these facilities.

Waivers, exceptions, or modifications (WEM's) to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 ro FS Manual 1650 and 2820.)

SU-MGH 294

Serial No. COC-61945

NO SURFACE OCCUPANCY STIPULATION
HIGH GEOLOGIC HAZARD
(EXPLORATION LICENSE APPLICATION)

No surface occupancy or use is allowed on the lands described below.

Areas of high geologic hazard have been mapped from aerial photographs and are characterized by active mudflows, active earthflows, active landslides and areas prone to avalanche. All areas within the lease with high geologic hazard are under jurisdiction of this stipulation.

For the purpose of:

Avoidance of areas with high geologic hazard to prevent mass slope failure.

Waivers, exceptions, or modifications (WEM's) to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

NSO-HGH 4/97

Serial No. COC-61945

NO SURFACE OCCUPANCY STIPULATION
SLOPES >60%
(EXPLORATION LICENSE APPLICATION)

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description). All areas within the leasehold with 60% slopes or greater fall under jurisdiction of this stipulation.

For the purpose of:

Protection of areas with slopes greater than 60% to prevent impacts to soil resources through erosion, mass failure, loss of productivity, etc.

Waivers, exceptions, or modifications (WEM's) to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

NSO-60%+ 294

Serial No. COC-61945

CONTROLLED SURFACE USE STIPULATION
SLOPES 40-60%
(EXPLORATION LICENSE APPLICATION)

Surface occupancy or use is subject to the following special operating constraints.

Special inter-disciplinary team analysis and mitigation plans detailing construction and mitigation techniques will be required on areas with slopes ranging from 40-60%. (Inter-disciplinary team disciplines could include engineering, soil scientist, hydrologist, landscape architect, reclamation specialist and oil and gas specialist.)

Mitigation may include use of erosion control cloths, mats, geoweb soil support materials, lifting and saving local native vegetation in chunks of sod to be later placed over disturbed areas, reseeding disturbed banks with stabilizing seed mix, use of chemical stabilizers, tackifiers and blankets and careful design of surface water flow.

For the purpose of:

Minimizing potential for soil loss, mass land movement, revegetation failure and unacceptable visual impairment.

Waivers, exceptions, or modifications (WEM's) to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1650 and 2820.)

CSU 40-60 4/97

Serial No. COC-61945

TIMING LIMITATION STIPULATION
SPECIAL WILDLIFE HABITATS
(EXPLORATION LICENSE APPLICATION)

No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of production facilities.

Elk calving and mule deer fawning areas:	April 15 to July 1
Elk and mule deer migration routes:	March 1 to May 30 November 1 to December 31
Elk and mule deer staging areas:	October 15 to December 31
Sage Grouse Leks and nesting areas: (Within a 2 ½ mile radius of the leks)	March 1 to June 1

On the lands described below:

a. Elk calving and mule deer fawning areas.
b. Elk and mule deer migration routes and staging areas.
c. Sage grouse leks and nesting areas.

All lands categorized as listed in a, b, and c above fall within jurisdiction of this stipulation.

For the purpose of (reasons):

Preventing human disturbance which would produce increased stress, leading to poor physical condition, winter mortality and/or reduced reproduction. These areas have been identified through a coordinated effort with the Colorado Division of Wildlife. Disturbance during the reproductive season may reduce her productivity. For nesting species, surface disturbance and associated human activity could disrupt breeding and/or cause nest abandonment. Disruption of migration routes or staging areas could result in direct mortality to big game species by disrupting annual normal staging and migration patterns to winter ranges. Animals could be dispersed or delayed in traveling to their winter ranges, causing direct mortality during normal fall/early winter snows.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

TL-SWH 294

STIPULATION FOR LANDS OF THE NATIONAL FOREST SYSTEM UNDER JURISDICTION OF THE DEPARTMENT OF AGRICULTURE

The license/permittee/lessee must comply with all the rules and regulations of the Secretary of the Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of the Interior in the license/permit/lease. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of a permit/operation plan by the Secretary of the Interior, (2) use of all existing improvements, such as Forest Development Roads, within and outside the area licensed, permitted or leased by the Secretary of Interior, and (3) use and occupancy of the NFS not authorized by a permit/operating plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed to:

Forest Supervisor
Grand Mesa, Uncompahgre, and Gunnison National Forests
2250 Highway 50
Delta, CO 81416
Telephone: 970-874-6600

LEASE NOTICE
INTERIM ROADS POLICY
(EXPLORATION LICENSE APPLICATION)

Lands combined within this lease are subject to the Forest Service interim Rule, "Administration of the Forest Service Development Transportation System: Temporary Suspension of Road Construction and Reconstruction in Unroaded Areas", Federal Register/Vol 64. No. 29/Friday, February 12, 1999, pages 7290 through 7305. These lands will also be subject to the final road management policy which will beset within 18 months.

No raod construction will be allowed within the unroaded area until the Forest Service adopts its revised road management policy or 18 months from the effective date of this final interim rule, whichever is sooner.

Appendix J

Forest Service Stipulations Elk Creek Coal Lease Tract

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Serial No. C-61357

CONTROLLED SURFACE USE STIPULATION GENERAL FOREST

Surface occupancy or use is subject to the following special operating constraints.

Underground mining operations will result in surface subsidence. The operator/lessee shall perform a study to secure adequate baseline data to quantify the existing surface resources on and adjacent to the lease area. Existing data may be used if such data is adequate for the intended purposes. The study shall be adequate to locate, quantify, and demonstrate the inter-relationship of the geology, topography, surface hydrology, vegetation and wildlife. Baseline data will be established so that future programs of observation can be incorporated at regular intervals for comparison.

The operator/lessee shall establish a monitoring system to locate, measure and quantify the progressive and final effects of underground mining activities on the topographic surface, underground and surface hydrology and vegetation. The monitoring system shall utilize techniques which will provide a continuing record of change over time and an analytical method for location and measurement of a number of points over the lease area. The monitoring shall incorporate and be an extension of the baseline data.

If subsidence adversely affects surface resources, or causes a documented water loss, the operator shall:

1. Restore stream channels and surface drainage or protect stream flow with earhtwork or temporary culverting; or

2. Restore affected roads; or

3. Revegetate as necessary to protect against erosion; or

4. Restore or replace surface structures or compensate the owner of those surface structures; or

5. Provide other mitigation.

On lands described below:

National Forest System Lands within the entire lease.

For the purpose of:

To insure the stability of surface resources and facilitate during and after the coal mining operations.

Waivers, exceptions, or modifications (WEMs) to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1650 and 2820.)

Coal-CSU-GF 2/95

(REVISED 2-28-95) Serial No. C-61357

CONTROLLED SURFACE USE STIPULATION
MODERATE GEOLOGIC HAZARDS

Surface occupancy or use is subject to the following special operating constraints.

Special interdisciplinary team analysis and mitigation plans detailing construction and mitigation techniques will be required on areas having moderate geologic hazards. (The interdisciplinary team could include: geotechnical engineer, soils engineer, roads engineer, coal mining engineer and reclamation specialist.) Attributes constituting moderate geologic hazard include stabilized earthflows, stabilized mudflows, stabilized landslides; slopes adjacent to failed slopes or active earthflows, mudflows, or landslides and avalanche chutes; areas of rockfall; and flash flood areas.

On lands described below:

Portions of Section 32, T12S, R90W, 6^{th} PM with moderate geologic hazards as generally delineated on a map prepared on 10-30-98 by Michael Ward. The map is for planning purposes only. The application of the definition of moderate geologic hazard to ground conditions will determine whether the stipulation applies. In the event of any conflict between written clauses of this stipulation and the map, the stipulation clauses shall control. All National Forest System Land within the leasehold which is classified as having moderate geologic hazards falls under jurisdiction of this stipulation.

For the purpose of:

To insure the stability of facilities required (such as roads, waterlines, water tanks, powerlines, ventilation shafts, ancillary buildings, drillpads, etc.) during the coal mining operations and to insure the stability of lands adjacent to these facilities.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEM's to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1650 and 2820.)

Coal-CSU-MGH 2/95

(REVISED 3-9-95) Serial No. C-61357

CONTROLLED SURFACE USE STIPULATION
HIGH GEOLOGIC HAZARD

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description) except when a waiver, exception, or modification (WEM) to this stipulation is granted. See WEM clause below.

Portions of Section 32, T12S, R90W, and Section 35, T12S, R91W, 6th PM are characterized by high geologic hazards defined as active mudflows, active earthflows, active landslides and areas prone to avalanche. Presumed areas of No Surface Occupancy are generally delineated on a map prepared by Michael K. Ward on 10-30-98. The map is for planning purposes only. The application of the definition of high geologic hazard to ground conditions will determine whether the stipulation applies. In the event of any conflict between written clauses of this stipulation and the map, the stipulation clauses shall control. All National Forest System Land within the leasehold which is classified as high geologic hazard falls under jurisdiction of this stipulation.

For the purpose of:

Avoidance of areas with high geologic hazard to prevent further mass slope failure.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a Forest Service discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Conditions under which a WEM may be granted include the following:

1. Use of the area for a short distance or a small area.

2. Mitigation and design can minimize impacts to soil and visual resources, for example, powerlines and waterlines required through these areas shall be constructed to minimize impacts.

3. No other alternative location for facilities and activities associated with coal mining is practical because of environmental effects and operational considerations (eg, economics, health and safety, etc.).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1950 and 2820.)

Coal-NSO-HGH 2/95

(REVISED 2-28-95) Serial No. C-61357

TIMING LIMITATION STIPULATION
BIG GAME WINTER RANGE

No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of facilities associated with coal mining.

1. Exploration, drilling and development activity will not be allowed during the period from December 1 to April 30. In the event of an emergency, surface use (including drilling) may be allowed with authorization from the Forest Service.

2. New roads on public lands will be closed yearlong to the public.

On the lands described below:

Portions of Section 32, T12S, R90W, and Section 35, T12S, R91W, 6^{th} PM with winter ranges for big game (elk) as generally delineated on a map prepared on 10-30-98 by Michael K. Ward. The map is for planning purposes only. The existence of big game winter range on the ground will determine whether the stipulation applies. In the event of any conflict between written clauses of this stipulation and the map, the stipulation clauses shall control. All National Forest System Land within the leasehold which is classified as big game winter range for elk falls under jurisdiction of this stipulation.

For the purpose of (reasons):

Prevent unnecessary stress on the wintering wildlife herds and causing an increase in mortality resulting from disturbances and habitat losses. These areas are critical for elk during winter. They serve as key concentration areas which support and sustain this species and are extremely important for animal survival.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1950 and 2820.)

Coal-TL-BGWR 2/95

(REVISED 2-28-95) Serial No. C-61357

CONTROLLED SURFACE USE STIPULATION
SLOPES 40-60%

Surface occupancy or use is subject to the following special operating constraints.

Special inter-disciplinary team analysis and mitigation plans detailing construction and mitigation techniques will be required on areas with slopes ranging from 40-60%. (The interdisciplinary team could include engineering, soil scientist, hydrologist, landscape architect, reclamation specialist and coal mining engineer.)

Mitigation may include, but is not limited to, use of erosion control cloths, mats, geoweb soil support materials, lifting and saving local native vegetation in chunks of sod to be later placed over disturbed areas, reseeding disturbed banks with stabilizing seed mix, use of chemical stabilizers, tackifiers and blankets and careful design of surface water flow.

On lands described below:

Portions of Section 32, T12S, R90W, and Section 35, T12S, R91W, 6th PM with slopes 40-60%. All National Forest System Land within the leasehold which has slopes ranging from 40-60% falls under jurisdiction of this stipulation.

For the purpose of:

Minimizing potential for soil loss, mass land movement, revegetation failure and unacceptable visual impairment.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1650 and 2820.)

Coal-CSU 40-60 2/95

(REVISED 2-28-95) Serial No. C-61357

CONTROLLED SURFACE USE STIPULATION
BIG GAME WINTER RANGE

Surface occupancy or use is subject to the following special operating constraints.

Operation and maintenance of facilities associated with coal mining such as roads, waterlines, water tanks, powerlines, ventilation shafts, ancillary buildings, and including monitoring will be scheduled to minimize adverse effects on big game (elk) from December 1 to April 30. Unscheduled use will be allowed in emergency situations with notice and coordination with the Forest Service.

Limit road use to periods when animals are not present on the winter range. Restrict road use to personnel associated with operation and maintenance of coal mining facilities. Recontour and revegetate to prior existing conditions (to extent possible) new roads when work is complete.

On lands described below:

Portions of Section 32, T12S, R90W and Section 35, T12S, R91W, 6th PM with winter range for big game (elk) as generally delineated on a map prepared on 10-30-98 by Michael K. Ward. The map is for planning purposes only. The existence of big game winter range on the ground will determine whether the stipulation applies. In the event of any conflict between written clauses of this stipulation and the map, the stipulation clauses shall control. All National Forest System Land within the leasehold which is classified as big game winter range for elk falls under jurisdiction of this stipulation.

For the purpose of:

Protecting big game winter range for elk. These ranges are extremely important for animal survival during winter. Disturbances and habitat losses may place unnecessary stress on the wintering wildlife herds and cause an increase in herd mortality.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1650 and 2820.)

Coal-CSU-WR 2/95

Serial No. C-61357

TIMING LIMITATION STIPULATION
FALL-WINTER SHUT-DOWN

No surface use is allowed during the following time period(s).

1. Exploration, drilling and development activity will not be allowed during the period from: October 1 through May 15, or whenever conditions in the spring are sufficiently dry to allow operations without causing surface damage. Operations between October 1 and the Friday preceding regular big game hunting season, usually around October 10, may be allowed during dry weather upon written authorization of the authorized officer.

2. New roads on public lands will be closed yearlong to the public.

On the lands described below:

All of the lease on National Forest System Lands within Section 32, T12S, R90W, and Section 35, T12S, R91W, 6th PM.

For the purpose of (reasons):

1. Protecting the soil and water resource, particularly with regard to roads and other surface disturbance.

2. Provide for safety of the general public and the operator.

3. Reduce user conflict during regular big game hunting seasons.

It may become necessary for a waiver, exception or modification (WEM) to this stipulation for the operator/lessee to use the surface in the area covered by this stipulation to allow for the recovery of the coal reserve. WEMs to this stipulation will be considered only at the time operations are proposed, and will be subject to the Forest Land and Resource Management Plan in effect at the time of consideration, and will be subject to applicable regulatory and environmental compliance requirements. Granting of a WEM is a discretionary action which the operator should not routinely expect. The Forest Service reserves the right to impose other stipulations in the same area of this leasehold if a WEM is granted.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3400 or FS Manual 1950 and 2820.)

Coal-TL-BG-S&W-10/98

STIPULATION FOR LANDS OF THE NATIONAL FOREST SYSTEM UNDER JURISDICTION OF THE DEPARTMENT OF AGRICULTURE

The license/permittee/lessee must comply with all the rules and regulations of the Secretary of the Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of the Interior in the license/permit/lease. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of a permit/operation plan by the Secretary of the Interior, (2) use of all existing improvements, such as Forest Development Roads, within and outside the area licensed, permitted or leased by the Secretary of Interior, and (3) use and occupancy of the NFS not authorized by a permit/operating plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed to:

Forest Supervisor
Grand Mesa, Uncompahgre, and Gunnison National Forests
2250 Highway 50
Delta, CO 81416
Telephone: 970-874-6600

LEASE NOTICE
INTERIM ROADS POLICY (LEASE TRACT)

Lands contained within this lease are subject to the Forest Service Interim Rule, "Administration of the Forest Service Development Transportation System: Temporary Suspension of Road Construction and Reconstruction in Unroaded Areas:, Federal Register/Vol. 64, No. 29/Friday, February 12, 1999, pages 7290 through 7305. These lands will also be subject to the final road management policy which will be set within 18 months.

No road construction will be allowed within the unroaded area until the Forest Service adopts its revised road management policy or 18 months from the effective date of this final interim rule, whichever is sooner.

Appendix K

Subsidence Evaluation

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES
(See EIS Figure Volume)

NOTE: There are four figures referenced in this appendix:

- K-1, Typical Subsidence Profile for Longwall
- K-2, Typical Longwall Subsidence Cross-Section
- K-3, Maximum Vertical Displacement for Longwall Mines
- K-4, Maximum Tilt and Strain

These figures are included in the attached EIS figure volume.

1.0 INTRODUCTION

Subsidence amounts and processes observed by the author and others in the Somerset-Paonia area are described and analyzed for planned longwall mining of coal on the north side of the North Fork of the Gunnison River in Delta and Gunnison counties, Colorado. This report is intended to serve as a technical reference document for the Elk Creek and Iron Point Coal Lease tracts (see *Figure 1, General Location Map*), of the North Fork Coal Environmental Impact Statement (EIS).

2.0 DEFINITION OF TERMS AND SYMBOLS

Terms used to evaluate and analyze subsidence processes and amounts are described below.

Longwall Mining: See *Appendix F, Overview of Underground Coal Mining.*

Mining Panel: A rectangular mining area where mine openings are developed and coal is extracted. In longwall mining panels, development entries, or gate roads, are driven at either side of the panel boundaries and the intervening coal is extracted with a longwall cutting machine.

Head Gate: The gate roads (development entries) driven on the side of the mining panel adjacent to unmined coal, and on the side of the panel that is in the direction of further panel development.

Tail Gate: Gate roads driven on the opposite side of the mining panel from the head gate entries.

Mining Length and Width (W, L): The length and width of the longwall panel where coal is being extracted.

Vertical Displacements: The vertical downward movement of the overburden and ground surface caused by extracting the coal.

Maximum Vertical Displacements (Maximum Subsidence): The maximum vertical downward movement of the overburden and ground surface caused by extracting the coal.

Tilt and Maximum Tilt (M): The change in vertical displacement between two points at the ground surface divided by the horizontal distance between these points (differential vertical displacement); maximum tilt is the maximum projected for this area of the subsidence trough.

Maximum Horizontal Strain (E, -E): The amount of horizontal change in length between two points of measurement divided by the horizontal distance between these two points (unit change in length); tensile strain is lengthening between these two points (unit elongation), compressive strain is shortening between these two points (unit shortening).

Subsidence Trough: A trough-like depression (downwarped area) that occurs above the panel where coal is being extracted; the trough is caused by differential vertical displacement of the ground surface.

Coal Extraction Thickness (t): The thickness of coal being mined; this value may be less than the actual seam thickness, because some coal of low quality may not be mined, some coal may be left in the roof ("top coal") for roof stability, or the seam may be too thick to be mined completely.

Overburden Depth (d): The vertical distance between the top of the coal seam being mined and the ground surface above it.

Critical Mining Width: The width of a mining panel necessary to cause maximum subsidence at a point on the ground surface. The length of the mining panel must also be equal to, or exceed this critical width. Critical width varies from 1.0 to 1.4 times the mining depth (overburden thickness).

Critical Mining Length: The length of the mining panel (length of coal area extracted) necessary to cause maximum vertical displacement (1.0 to 1.4 times the overburden depth).

Supercritical Mining Length and Width: A mining panel with a length and width that is greater than critical mining width.

Super Panel: Two or more mining panels that behave like one large panel; the overlying subsidence profile looks essentially like one large, single panel.

Draw (Limit) Angle (ϕ): The angle (from a vertical reference) of a straight line projected from the edge of the mining panel to the limit of subsidence at the surface above the edge of panel.

Break Angle (β): The angle (from a vertical reference) of a straight line projected from the edge of the mining panel to the point of maximum lengthening (maximum horizontal strain) at the surface above the edge of the panel.

Bedrock: Rock that was originally formed under natural conditions, in contrast to unconsolidated material (colluvium, alluvium, and soil) derived bedrock.

Cleat: A system of planar fractures, or partings, in coal; there commonly are two cleat sets that are nearly perpendicular to each other.

Lineament: A linear topographic feature, which can be observed on-site and on aerial photographs, that often indicates a fault or an extensive fracture or fracture system.

Joint: A fracture surface or parting in rock, usually planar, without displacement, which often occurs periodically to form a joint set.

Fault: A fracture surface, parting, or series of partings in rock, often more extensive than joints, where rock on either side of the surface, or surfaces, is displaced (offset).

Bulking Factor: The volumetric increase of caved rock fragments relative to their volume prior to caving (in-place volume).

Coal Bump: The sudden release of strain energy that produces an explosion-like sound and shock waves in locations where stress (pressure) on the coal exceeds its strength.

Rock Burst: The sudden release of strain energy that produces an explosion-like sound and shock waves in locations where stress on the rock exceeds its strength.

3.0 GENERAL MINING INFORMATION

Longwall mining is planned for both the Elk Creek and Iron Point Coal Lease tracts.

3.1 Elk Creek Tract

3.1.1 Panel Design

Panels in the Elk Creek Coal Lease Tract are projected to be arranged in groups of three or four, oriented in a north-south direction. A barrier pillar about 300 feet wide is planned to be left between each panel group. All panels will be oriented in the north-south direction. Each of the longwall panels is projected to be a maximum of 800 feet wide, and range from 7,300 feet to 13,500 feet in length. Overburden depth (depth of cover), relative to the D seam, ranges from about 500 feet, in the southern part of the tract, to 2,500 feet in the northern part. Coal extraction thickness reportedly will range from 9 to 12 feet; 12 feet is used herein as a conservative maximum thickness in the subsidence analysis.

3.1.2 Pillar Configuration and Design

Two yield pillars are currently expected to be developed in an offset pattern—on 70 by 120-foot centers at the head gate entry and 50 by 120-foot centers on the tail gate entry. Cross cut centers of each row of gate road pillars will be offset 60 feet from the adjacent row.

3.2 Iron Point Tract

3.2.1 Panel Design

D seam panels are projected in about an east-west direction in a single group. Each panel is projected to have a maximum width of about 900 feet (including the yield pillars on the tail gate entries). The panels will range in length from about 6,500 to 7,000 feet. In the B seam, which is stratigraphically below the D seam, panels will have to be designed around the historic (now abandoned) King Mine. Panels will range in width from 700 to 900 feet, and in length from 2,500 to 7,000 feet. Panel orientation will also vary, trending from an east-west direction to a north-south direction. Overburden depth, relative to the D seam, will range from about 500 feet to 2,500 feet. Coal extraction thickness is planned to be 10 feet.

3.2.2 Pillar Configuration and Design

One row of yield pillars and one row of stiff pillars is planned for the head gate and tail gate entries. The centerline dimension of the stiff pillars are currently planned to be 113 feet by 200 feet; the centerline dimension of the yield pillars 53 feet by 100 feet. Every other cross cut of the yield pillars will line up with the stiff pillar cross cuts.

3.3 Previous Mining

The B and C coal seams have been locally mined by the room-and-pillar method in the southern part of the Elk Creek Coal Lease Tract. See *Figure 3, Historic Coal Mines and Federal Coal Lease Locations,* in the attached EIS figure volume. Prior B seam mine workings are also located in the southern part of the Iron Point Coal Lease Tract. In both tracts, the D seam is separated stratigraphically from the C seam by 150 to 200 feet of sandstone, siltstone, and shale; the D seam is separated stratigraphically from the B seam by 225 to 300 feet of similar rocks (Dunrud, 1989).

3.3.1 Mining in Disturbed Ground

The author measured subsidence of as much as 50 percent of the mining thickness (0.5 t) above room-and-pillar extraction panels in the Somerset Mine (Dunrud, 1998, p. 92-93). However, the panels were bounded by barrier pillars 50 to 75 feet wide, which only yielded on the order of 30 to 40 percent of the mining thickness where the overburden depth was 500 to 1,000 feet. Any subsidence created by this past mining (on the order of 30 percent to 50 percent of the mining thickness) is likely complete by now, since this mining occurred many years (or even decades) ago.

3.3.2 Subsidence Amounts in Disturbed Versus Undisturbed Ground

Average maximum vertical displacement (S) for undisturbed ground, according to the National Coal Board (NCB) (NCB, 1975, p.10) is about 90 percent of the amount measured in disturbed ground (i.e. 0.9 x 0.9=0.8t). See *Figure K-3, Maximum Vertical Displacement for Longwall Mines*. Maximum subsidence (S), therefore, is projected to be about 90 percent of the amount of subsidence in undisturbed ground relative to disturbed ground. Therefore, average maximum subsidence due to D seam mining in undisturbed ground, is projected to be 0.6 of the coal extraction thickness (0.6t), whereas it is projected to be 0.7t when the D-seam is mined above existing mine workings in the B and C seams.

3.3.3 D Seam Mining Stresses and Deformations

Mining in the D seam may cause some additional deformation of unmined pillars in the lower seams, which could then cause some additional impact at the mine level when the D seam is mined. However, any increase in subsidence will likely only be on the order of 10 percent, as indicated by the NCB (1975, p. 10).

3.4 Multiple Seam Mining

Subsidence is projected to be additive, where mining occurs in more than one coal seam in the lease tracts. This includes maximum vertical displacement (subsidence) (S), tilt (M), and horizontal strain (E, -E).

- This projection is conservative, because it basically assumes that both seams are mined very quickly, if not instantaneously. In reality, the strain effects of mining one seam will be reduced by a varying extent (depending on the length of time until the next seam is mined) by filling, healing, and sealing of any cracks present by the natural forces of erosion and sedimentation.

- In the event that the B and D seam seams are sequentially mined in the Elk Creek and/or Iron Point Coal Lease tracts, subsidence would occur in sequence with coal extraction.

- For example, in undisturbed ground in the Iron Point Coal Lease Tract—should an average of 10 feet of coal be extracted in a panel of critical to supercritical width in the D seam, followed by an average of 10 feet of coal from the B seam—the following maximum vertical displacement (maximum subsidence) is projected:

    1. D seam extraction first—mining occurs in undisturbed ground; maximum average subsidence = 6.0 feet (0.6 X 10 feet, from *Figure K-3, Maximum Vertical Displacement* for Longwall Mines).

2. B seam extraction later—mining now occurs in disturbed ground; maximum average subsidence = 7.0 feet (0.7 X 10 feet, see *Figure K-3, Maximum Vertical Displacement for Longwall Mines*).

3. Total maximum average subsidence for extraction of both coal seams would therefore be 13.0 feet (6.0 + 7.0 feet).

3.5 Compression Arches and Related Stresses

Compression arches commonly develop above areas where the coal is being mined. These arcuate zones of compressive stress transfer much of the weight of the overburden to the arch abutment zones ahead, behind, and on either side of the area being mined (somewhat like stone-arched bridges transfer their weight and load to the bridge abutments).

- Compression arches can support relatively high compressive stresses, compared to tensile stresses, because rock is strong in compression but weak in tension. The major abutment zones in a longwall mining operation are (1) the caved zone (gob) behind the supports, (2) the unmined coal ahead of the face, and (3) the gate road pillars.

- In a longwall mining operation, where the roof rocks cave behind the support, much of the weight of the overburden is borne by the re-compressed caved material (gob). This minimizes the abutment load (stress) on the coal ahead of the face. Abutment stresses are smallest where the roof caves close to the longwall supports, because the length of the arch and the supported weight of the overburden are reduced.

- Caving, which is necessary to form an abutment zone, is controlled by the lithology of the roof rocks. Thin layered shales, siltstones, and claystones cave readily, whereas thick sandstones may cave with difficulty. Coal mine bumps and rock bursts are minimized both in number and magnitude where the roof rocks consist of shales and claystones, but may occur in greater frequency and magnitude where the roof rocks are strong sandstones.

- Mining stresses increase with increasing overburden depth. Room-and-pillar extraction mining becomes significantly more difficult in overburden more than 1,500 to 2,000 feet thick, because mine roofs and pillars become unstable. Miners often are forced out of an area before complete caving can occur, thus causing additional abutment stresses and attendant bumps and rock bursts. The longwall method overcomes much of the roof and pillar stability problems, so that abutment stresses are lower than in coal mined by the room-and-pillar method. Longwall mining in the D seam in the Elk Creek Coal Lease Tract and the D and B seams in the Iron Point Coal Lease Tract should be viable to 2,500 feet or more, because the roof rocks above both of these seams should cave readily.

- Bumps and rockbursts, and related seismic activity commonly occur in greatest number and magnitude where a large uncaved area develops behind the longwall supports, or where large pillars, which can store large amounts of strain energy, occur in the abutment zones of the compression arch. It is necessary to achieve a balance between gate road pillar and barrier pillar design for mine stability and safety of personnel and to also design for minimal subsidence effects.

- For a given point of observation on the surface, the compression arch has dissipated when subsidence is complete. Subsidence is nearly complete when critical extraction length and width is 1.0 to 1.4 d. For mining panels of subcritical width, the arch may not dissipate until an adjacent panel is mined. Also more subsidence will likely occur when the next longwall panel is mined.

3.6 Seismic Activity

Coal bumps and rock bursts have been a cause of sporadic seismic activity in the Somerset area over the last 30 years or so. For example, a bump occurred at about 4 AM in the fall of 1968 in the Somerset Mine that awoke local residents and shook buildings in the Somerset area severely.

- More than 4,000 seismic events, with magnitudes of as much as 3.8 on the Richter scale, were recorded near or within 30 mine areas in the contiguous Wasatch Plateau and Book Cliffs coal mining districts from January 1978 to March 1996 (Arabasz and others, 1997).

- The author and others recorded thousands of seismic events on a seismic network operated by the USGS in the Sunnyside district during the mid-to late 1960s. One episode of seismic events occurred beneath the Geneva Mine in the Sunnyside mining district during October 1967 (Dunrud, 1998, p 70-81). The seismic events, which were all of sufficient magnitude to locate a hypocenter (x, y, z location), ranged from 1.3 to 3.1 on the Richter scale. Hundreds more seismic events, too small to locate on the seismic network, occurred over a period of a few days in the general area where the bumps occurred. Though mine damage was very severe (at least 10,000 tons of coal was explosively released), these major seismic events fortunately occurred 3,000 to 6,000 feet below the bump-damaged mine area near faults and a large fault zone that was detected in seismic refraction studies, and drilling logs.

- The USGS recorded 12 seismic events during the first half of September 1969 in the Somerset Mine area, using an eight-station seismic recording network. The events, which range from 1.8 to 2.7 on the Richter scale, were located between Bear Creek and Hubbard Creek, but at depths ranging from 1,000 to 6,000 feet below the mine workings (Osterwald and others, 1972, 27 pages). This is a very small seismic sample. Relations similar to those found by the author in the Sunnyside district (Dunrud, 1998, p. 76 and 78) and by Arabasz and others (1997) may or may not exist. A larger monitoring period, using a network capable of locating mine-induced seismic activity, would be necessary to determine a more accurate relationship among mining, geology, and related seismic events in the Elk Creek and Iron Point Lease tracts.

- Results from a seismic recording station located in Elk Creek showed that increased seismic activity often coincided with increased stresses near and within the Somerset room-and-pillar mine workings. The stress increases often occurred where unstable roof conditions and or bumps in the pillars forced miners out of an area before extraction is complete. Caving in these areas was not extensive enough to cause transfer of abutment stresses to the caved area.

- Coal mine bumps and rockbursts, with accompanying seismic activity are often the result of incomplete or irregular room-and-pillar mining practices (Dunrud, 1976, p. 28-29). Earth tremors generated by bumps and rock bursts in the Somerset Mine during the mid-1990s were felt over a large area. The seismic event was of sufficient magnitude to be recorded at the USGS National Earthquake Center in Golden, Colorado and to be verified as being in the abandoned Somerset Mine.

- Tremors of this magnitude may have some impact on sensitive structures, as well as the least stable landslide and rockfall areas. However, the author observed no rockfalls or movement on landslides during the Rulison nuclear explosion (Richter magnitude of 5.2) at his monitoring site 200 yards south of the confluence of Hubbard Creek and Iron Point Gulch. From this vantage point, which is surrounded by geologic hazards (see *Figure 11, Geologic Map*), he experienced a strong up-and-down motion, followed by an even

stronger, horizontal back-and-forth motion. No rocks moved that were perched on the steep slopes and ledges and no movement occurred on landslides in the area when the canyon walls were subjected to this level of shaking.

- In planned longwall mining in the Elk Creek and Iron Point Coal Lease tracts, seismic activity is projected by the author to be significantly lower than in the previously-mined room-and-pillar extraction in the area. Because extraction is complete in the panels, abutment stresses are more effectively transferred to, and supported by, the caved zones. An exception to this general protection would be where the mine roof rocks are strong, and do not cave until a large area (perhaps a distance of 100 to 300 feet and the width of the mining panel) of coal is extracted. A tremor (seismic event), or series of tremors, will be likely when caving does occur. Rocks above the D and B seams are shales, siltstones, and thin sandstones. These rocks will likely cave readily behind the longwall supports. Therefore, the abutment stresses and related seismic activity are projected to be low.

- Many areas of the abandoned Somerset Mine likely remain under a high state of stress because large blocks of coal were left behind. Some of these blocks of coal, called bump blocks, were left behind between Bear Creek and Hubbard Creek; others were abandoned because of unsafe conditions due to high stress. Based on the author's knowledge of these conditions, future seismic events, caused by bumps and rockbursts in abandoned room-and-pillar mine areas, are likely to be of greater magnitude than the seismic activity produced by longwall mining in the Elk Creek and Iron Point Lease tracts.

4.0 GEOLOGICAL AND GEOTECHNICAL FACTORS INFLUENCING SUBSIDENCE

4.1 Structure

The attitude of the bedrock, faults, lineaments, joints, and cleat are important factors to consider in the design of longwall mining panels. In the Elk Creek and Iron Point Lease tracts, the bedrock dips northeastward at 2½ to 4 degrees. The gentle dip is not expected to affect the angle of draw more than 4 or 5 degrees from that of flat-lying beds based on NCB information (NCB, 1975). The projected range of 10 and 20 degrees for the angle of draw in the Elk Creek and Iron Point Lease tracts is projected to accommodate this gentle bedrock attitude. The gentle dip of bedrock in the lease tracts also will allow a wide latitude in the design of the most efficient panel orientation and resource recovery. The dominant lineament and joint directions, based on a plot of lineaments from a Skylab 2 color infrared image (Dunrud, 1976, p. 15) are north 30-35 east, north 65-70 west, and north 75-80 west. The dominant cleat directions are about North-South and East-West. Geologic mapping in the lease tract areas, as well as other coal mining areas in the North Fork Valley, records that the faults, major joints, and coal cleat all dip steeply to vertically (Dunrud, 1989 and Dunrud, 1976, pp. 11-13). The dip of these features ranges from approximately 75 to 90 degrees.

The surface is locally transected by small, nearly vertical faults and lineaments that trend about north-south, northwest, northeast, and east-west (Dunrud, 1989). Observed offset at the surface of the faults commonly ranges from a few feet to a few tens of feet. Based on mapping in other parts of the Somerset area, the faults may or may not transect the B and D coal seams.

- Orientation of joints in the roof rocks and the cleat in the coal commonly controls the way the roof rocks break and cave and how the coal breaks off when cut by the longwall machine. For example:

    1. The roof caves readily behind the longwall supports where joints in the roof rocks are oriented nearly parallel to the longwall face.

2. The coal may break off in large chunks, however, where the coal cleat is oriented parallel to the longwall face. The longwall face may therefore need to be oriented so that the cleat and longwall face directions diverge 10 degrees or more.

4.2 Strength and Behavioral Properties of the Rocks

These properties control the amount and rate of subsidence. Strong, brittle sandstones and siltstones, for example, may break and cave to the mine floor in larger blocks and fragments than softer, more yieldable shales and siltstones, which controls the bulking factor of the caved debris.

- The height of caving above the mine workings is reduced, for example, where the roof rocks consist of strong sandstones compared to weak shales. However, the height of fracturing is greater for strong, brittle sandstones compared to weak, more yieldable shales.

4.3 Stratigraphic Sequence

The stratigraphic position of strong and weak rocks within the overburden, in addition to the rocks near the mine workings, commonly affects subsidence in various ways.

- Strong, brittle sandstones, on the order of 50 to 100 feet thick, for example, tend to reduce the amount of subsidence compared to weak, more yieldable shales.

- However, strains are often greater in these sandstones, because their greater compressive strength produces more extension in the tension zone than do the weaker, yieldable shales.

- The so-called Bowie Sandstone, ranging from about 50 to 150 feet thick, which underlies the D seam, may reduce the amount of subsidence caused by mining the B seam compared to the amount of subsidence caused by D seam mining.

4.4 Moisture Content

Wet rocks in the mine roof and overburden tend to reduce the bulking factor of the caved rocks near the mine level and also tend to cause the rocks to be weaker and more yieldable than their dry counterparts. This reduction in bulking factor is because wet rocks usually are weaker (in compressive, shear, and tensile strength) compared to their dry counterparts.

- For a given stratigraphic sequence and coal extraction thickness, subsidence amount and affected area generally increase with moisture content. In saturated strata, for example in the U. K. and former Yugoslavia, maximum subsidence reportedly ranges from 0.9 to 0.98 times the coal extraction thickness in disturbed ground, and the draw (limit) angle ranges from 30 to 45 degrees (vertical reference) (Dunrud, 1998, p. 85-99). See *Figure 12, Typical Geologic Cross-Section*, in the attached EIS figure volume.

- In the Elk Creek and Iron Point Coal Lease tracts, average maximum vertical displacement (subsidence) is projected to range from 0.5 to 0.7 times the coal extraction thickness (0.5 to 0.7t) and average 0.6 times the coal extraction thickness (0.6t) in undisturbed ground and 0.6 to 0.8t and an average of 0.7t in disturbed ground. The draw angle in these essentially dry overburden rocks is projected to be 10 to 20 degrees (vertical reference), with an average of 15 degrees.

5.0 TOPOGRAPHIC FACTORS AFFECTING SUBSIDENCE

5.1 Rugged Terrain

The Elk Creek and Iron Point Coal Lease tracts are located in cliff-canyon-ridge topography. Slopes as steep as 75 to 80 percent in the Barren member of the Mesaverde grade upwards to nearly vertical cliffs in the Ohio Creek member. Because of this rugged terrain, predictions of subsidence and related surface impacts are less certain than would be the case in more gentle terrain. For example, vertical displacement, and related tilt and strain, may be as much as 30 percent greater in the ridge and steep slope areas than in adjacent valleys when the underlying coal is extracted.

Fewer cracks occur in valleys than on ridges, because the valleys are more stable as a result of complete lateral constraint. Consequently subsidence impacts are likely to be greater than they would be in subdued terrain, because the lateral constraint is reduced to nearly zero on steep valley slopes.

- Strains and displacements on steep slopes, particularly cliffs, may cause cracks on the order of a few inches to possibly 1-foot wide and 25 to 50 feet deep, compared to a fraction of an inch to a few inches wide and a few feet deep in the gentle terrain of the valley bottoms. Cracks will tend to be widest (perhaps ½ feet to l ½ feet wide) and deepest (possibly 75 to 100 feet) along prominent joints and fractures on the steepest slopes and cliffs, which, in turn may become less stable and more susceptible to landslides and rockfalls. See *Figure 11, Geologic Hazards Map*, and *Figure 14, Subsidence Potential Map*, in the attached EIS figure volume.

- Landslides and rockfalls will be most likely to occur where mining is planned near the outcrop, where tilts and strains are greatest. Based on the author's experience in the North Fork area, the greatest subsidence impact is likely to occur in geologic hazard areas where the following two conditions occur:

  1. The subsidence-induced tilt direction parallels the slope direction, which further increases the slope.

  2. The direction of longwall face movement parallels the slope direction which tends to further increase surface strain, as the longwall face moves from deeper towards shallower overburden.

  See *Figure 11, Geologic Hazards Map*, in the attached EIS figure volume.

5.2 Variable Overburden Thickness

For any mining panel width and coal extraction thickness, the maximum subsidence amount, tilt, and strain commonly decrease with increasing overburden depth. A single panel may range from supercritical in shallow overburden to subcritical in deeper overburden.

- Gate road pillars will tend to yield more with increasing overburden depth, such that two or more adjacent panels begin to behave more and more like a superpanel at overburden depth greater than 1,000 to 1,500 feet. At these depths, the pillars will likely yield to the level of the recompacted, caved, and broken rock in the longwall panel.

6.0 SUBSIDENCE EVALUATION OF LONGWALL MINING OF THE D SEAM IN THE ELK CREEK AND THE D AND B SEAMS IN THE IRON POINT COAL LEASE TRACTS

The author uses the subsidence prediction method for trough subsidence developed by the NCB (NCB, 1975).

- The NCB is the world's foremost organization studying and analyzing subsidence caused by underground mines. Using their expertise, which was developed over many decades by this organization, coal is routinely mined under cities, rivers, and other sensitive structures and areas. Knowledge and use of the NCB method is therefore very useful in analyzing subsidence processes and parameters and in evaluating subsidence impacts in a proposed mining area.

- The NCB method—which is basically a conceptual model consisting of the fundamental factors of coal extraction thickness, subsidence amount, mining width, and overburden depth—can be adjusted for overburden lithology, moisture conditions, mining panel width, and coal extraction thickness.

- The NCB subsidence method of analysis was adapted and modified for local conditions observed and measured in both room-and-pillar mines and longwall mines in the North Fork Valley. Subsidence information and experience is also drawn from underground mining operations in New Mexico, Utah, Wyoming, other coal mining areas of the United States and the former Yugoslavia.

- In order to verify the validity of the NCB subsidence analysis method, and that it was correctly adapted to local geologic and mining conditions, a computer modeling process was also used in the permitting process of a longwall mine in the North Fork Valley. This modeling process, called the Comprehensive and Integrated Subsidence Prediction Model (CISPM), was developed by Syd S. Peng (one of the world's leading subsidence authorities) and Yi Luo, College of Mining Engineering, Department of Mining and Engineering, West Virginia University. When both models were calibrated for local conditions, the CISPM model, which basically performs an influence function analysis and is therefore independent of the NCB model analysis, closely confirmed the values of vertical displacement, tilt, and strain determined by the NCB conceptual model. The modeling comparison also indicated that the NCB model was often more conservative than the CISPM model by a few percent.

6.1 Subsidence Zones

There are four zones to consider and analyze, in the trough subsidence process, based on studies and experience by the author and others (for example, Peng, 1992). These are the (1) caved, (2) fractured, (3) continuous deformation, and (4) near-surface zones. See *Figure K-2, Typical Longwall Subsidence Cross-Section.*

6.1.1 Caved Zone

This zone, according to Peng (1992, p. 1-2) ranges from 2 to 8 coal extraction thicknesses (2t to 8t), depending on lithology and moisture content of the roof rocks.

- In the Elk Creek and Iron Point Coal Lease tracts, 3 to 5 coal extraction thicknesses (3t to 5t), with an average of 4 coal extraction thicknesses (4t) are projected, based on the author's experience with this lithology and the commonly dry conditions in the rocks above

the D seam. See *Figure 12, Typical Geologic Cross-Section*, in the attached EIS figure volume.

- The height of the caved zone may range from 4 to 6 times the coal extraction thickness (4t to 6t), where the D seam is locally water-bearing. The height of caving in the D seam will therefore be closer to 3t where the roof rocks are composed primarily of dry sandstones, and closer to 6t where the D seam is saturated and the roof rocks consist mainly of shales and claystones.

6.1.2 Fractured Zone

Rocks in this zone undergo fracturing within rock layers and along the boundaries of these layers. It is transitional to the underlying caved zone. See *Figure K-2, Typical Longwall Subsidence Cross-Section*. For a given lithology, displacements and intensity of fracturing tends to decrease upward. Thus water (hydraulic) conductivity also tends to decrease upward.

- Peng (1992, p. 143) states that the upper 1/3 of this zone has only minor, unconnected fractures and thus has only minor potential for water conductivity, that most of the water conductivity potential is in the lower two-thirds of this zone, and that the water conductivity increases downward.

- According to Peng (1992, p. 6-8), the height of fracturing is a function of lithology and thickness of stratigraphic layers. According to Liu (1981, in Peng, 1992, p. 6-9), the fracture zone ranges from 20 to 30 times the coal extraction thickness (20 to 30t) for overburden comprised predominantly of hard, brittle sandstones and limestones, whereas, the zone ranges from 9 to 11 times the coal extraction thickness (9 to 11t) for overburden consisting predominantly of ductile shales and claystones.

- For the Elk Creek and Iron Point Coal Lease tracts, the height of the fractured zone is projected to be 10 to 20 times the coal extraction thickness (10 to 20t), with an average of 15 times the coal extraction thickness (15t). This projection is based on the best information available to the author in the literature and on the author's experience in the area. See *Figure 12, Typical Geologic Cross-Section*, in the attached EIS figure volume.

6.1.3 Continuous Deformation Zone

This zone, which is transitional to the underlying fracture zone, occurs from the upper limit of the fractured zone upwards to the near-surface zone. See *Figure K-2, Typical Longwall Subsidence Cross-Section*. The downwarping process (trough subsidence) causes various rock units in the overburden to deform as multiple plates (or multiple beams in two dimensions).

- The downwarping of strata as multiple plates causes tensile strains to develop where convex-upward curvature occurs above the neutral surface, and compressive strains where concave-downward curvature occurs below the neutral surface of the plate (see *Figure K-2, Typical Longwall Subsidence Cross-Section*, inset e,f,g,h).

- Crack depth is therefore controlled by the distance to the neutral surface of the rock unit being downwarped, because compression occurs below the neutral surface. Therefore cracks are not vertically continuous, but are controlled by the thickness of the individual rock units.
- Slippage (flexural slip) also occurs at the surfaces between the rock units behaving as plates.

6.1.4 Near-Surface Zone

Nearly all measurements are made at the top (surface) of this zone. It typically consists of one or more of (1) bedrock, (2) weathered bedrock, (3) colluvium, (4) alluvium.

- The behavior of the material in this zone is a function of its continuum deformational characteristics (i.e. its ability to yield or stretch without rupturing or breaking). Bedrock is typically the most rigid (least yieldable) (except perhaps in a claystone); alluvium commonly is the least rigid (most yieldable).

- The near-surface zone, therefore, has an extremely variable ability to stretch without rupturing—bedrock, rigid (except for some claystones); weathered bedrock, typically less rigid; colluvium, somewhat yieldable to very yieldable; alluvium, typically very yieldable.

- The following subsidence case history was observed by the author in the late summer and early fall of 1976 while mapping the geology in the Bear Creek area for the U.S. Geological Survey. This case history is a local example of how different types of near-surface material behave in response to horizontal strain caused by subsidence. The area was located above a room-and-pillar mine in the B seam where the coal extraction thickness was 10 feet and the overburden depth ranged from 250 to 500 feet. Mine records show that a partial extraction mining procedure (about 50 to 60 percent of the coal was removed) was completed in December 1976.

    1. Crenulate (irregular), en-echelon (offset) cracks as much as 10 in to 1-foot wide, and 25 to 50 feet long trending roughly parallel to the stream and the pillar extraction line, were observed by the author in weathered bedrock and colluvium a few feet thick on the east side of the valley 75 to 100 feet above Bear Creek. The crack depth was difficult to estimate, because extensive sloughing had already occurred. However, the cracks likely ranged between 3 and 10 feet deep.

    2. Cracks 4 to 8 inches wide and 10 to 20 feet long were also mapped on the west side of Bear Creek. These cracks occurred on either side of the extraction panel and trended nearly parallel to the boundaries. The cracks crossed the road and extended eastward upslope and westward towards the stream.

       The cracks, as mapped by U.S. Steel personnel, show that the cracks on either side of the panel intersected the stream, however the author has no knowledge that they extended to the stream.

    3. Small, crenulate cracks a fraction of an inch to an inch or two wide, 10 to 25 feet long, and a few inches to perhaps 1-foot deep, could be seen in colluvium an estimated 10 to 20 feet thick, and located 15 to 30 feet above the stream.

    4. No cracks were observed in saturated alluvium underlying the Bear Creek stream. The thickness of the alluvium was estimated to be 10 to 15 feet and the underlying colluvium 30 to 50 feet. The author did not observe any loss of flow downstream in Bear Creek from this area, and no loss was reported to the author's knowledge.

       a. There are two possibilities for this observation of no cracks and no flow loss:

          1) The alluvium stretched without rupturing when mine subsidence occurred beneath the stream channel.

2) Cracks in the alluvium healed and sealed naturally prior to the author visiting the site. Healing and sealing of any cracks present in the stream alluvium may be a viable alternative, because the vertical limit of cracks would only be about one-half the alluvium thickness. The alluvium would likely be in compression below the neutral surface. In addition, siltation during periods of increased flow could fill any cracks present. See *Figure K-2, Typical Longwall Subsidence Cross-Section* (inset e, f, g, h).

7.0 SUBSIDENCE PARAMETERS ANALYZED IN THE ELK CREEK AND IRON POINT COAL LEASE TRACTS

- Subsidence parameters analyzed are (1) maximum vertical displacement (commonly called subsidence) (S); (2) tilt (M), (3) positive and negative horizontal strain (extension, E; compression, -E); (4) draw (limit) angle (ϕ); and (5) break angle (β). See *Figure K-1, Typical Subsidence Profile for Longwall.*

7.1 Maximum Vertical Displacement (Subsidence) (S)

Maximum vertical displacement, or what is commonly considered subsidence, ranges from 0.5 times the coal extraction thickness (0.5t) for critical and supercritical room-and-pillar extraction panels in undisturbed ground of the Somerset Mine to 0.98 times coal extraction thickness (0.98 t) in overburden disturbed by dewatering in the former Yugoslavia (Dunrud, 1998, p. 89). See *Figure K-3, Maximum Vertical Displacement for Longwall Mines*.

- For undisturbed ground and critical to supercritical longwall mining panels, S is projected to range from 0.5t in valleys to 0.7t in ridge areas and average 0.6t in the Elk Creek and Iron Point Coal Lease tracts.

- For disturbed ground (critical to supercritical panels), S is projected to range from 0.6t in valleys to 0.8t in ridge areas, and average 0.7t in these lease tracts.

- Calculated ranges of S in undisturbed and disturbed ground, for various overburden depth ranges, are displayed in *Table K-1, Maximum Vertical Displacement*. Calculations are based on a panel width of 800 feet and a maximum coal extraction thickness of 12 feet in the D seam for the Elk Creek Coal Lease Tract, and a panel width of 900 feet and maximum coal extraction thickness of 10 feet in the D-seam and 10 feet in the B seam for the Iron Point Coal Lease Tract:

- Maximum Vertical Displacement (S) (first 4 columns are D seam mining only; 5th column—Iron Point D & B assume D seam mining is in undisturbed ground and B seam mining is in disturbed ground; add 10 percent to column 5 if D seam mining is in disturbed ground):

Table K-1 Maximum Vertical Displacement (S) (D seam=12 ft for Elk Creek Tract; D and B seams=10 ft for Iron Point Tract)					
Overburden Depth (ft)	**Elk Creek Undisturbed (ft)**	**Elk Creek Disturbed (ft)**	**Iron Point Undisturbed (ft)**	**Iron Point Disturbed (ft)**	**Iron Point D & B Seams (ft)**
100 - 250	7.2	8.4	6.0	7.0	13.0
250 - 500	7.2	8.4	6.0	7,0	13.0
500 - 1,000	7.2 - 6.0	8.4 - 6.9	6.0 - 5.5	7.0 - 6.3	13.0 - 11.8
1,000 - 1500	6.0 - 4.1	6.9 - 4.8	5.5 - 4.0	6.3 - 4.5	11.8 - 8.5
1,500 - 2,000	4.1 - 2.4	4.8 - 3.0	4.0 - 2.6	4.5 - 3.0	8.5 - 5.6
2,000 - 2,500	2.4 - 1.6	3.0 - 1.8	2.6 - 1.7	3.0 - 2.0	5.6 - 3.7

7.2 Maximum Tilt (M)

Maximum tilt (called slope by NCB, 1975; but called tilt by the author to distinguish it from the slope of the terrain) is plotted and analyzed in terms of the fundamental ratios of maximum vertical displacement to overburden depth (S/d) versus the ratio of mining panel width to overburden depth (W/d). See *Figure K-4, Maximum Tilt and Strain.*

- These ratios are fundamental because subsidence is proportional to mining width and inversely proportional to mining depth. Therefore, a plot of S/d versus W/d will provide tilt and strain values for mining at any depth—whether subsidence occurs above mines only 60 to 100 feet deep, as in the Sheridan, Wyoming area, to mines more than 2,000 feet deep in various areas of Utah.

- Maximum tilt (M) is projected to range from a maximum of 3.5 S/d for mining panels of subcritical width to 3.0 S/d for mining panels of critical to supercritical width. See *Figure K-4, Maximum Tilt and Strain.*

- Calculated maximum tilt ranges (in percent) for various overburden depths for the Elk Creek and Iron Point Coal Lease tracts are shown in *Table K-2, Maximum Tilt*; for the Elk Creek Coal Lease Tract, mining panel width (W) = 800 feet and maximum coal extraction thickness (t) = 12 feet; for the Iron Point Coal Lease Tract, W = 900 feet and t = 10 feet for the D seam and also the B seam.

- Maximum tilt will likely be twice the amount projected in *Table K-2, Maximum Tilt*, over stiff barrier pillars planned between longwall panel groups in the Elk Creek Coal Lease Tract. Tilt occurring on each side of the barrier probably will cause a doubling of the tilt value, because the overburden and ground surface will tilt towards both adjacent longwall panels.

- Maximum tilt in the first 4 columns of *Table K-2, Maximum Tilt*, is for D seam mining only in the Elk Creek and Iron Point Coal Lease tracts, using subsidence values in *Table K-1, Maximum Vertical Displacement*. In column 5, *Table K-2, Maximum Tilt*, maximum tilt for both D seam mining and B seam mining in the Iron Point Coal Lease Tract is shown, assuming that D-seam mining is in undisturbed ground and B seam mining is in disturbed ground. Add 10 percent to the values in column 5 if D seam mining is in ground disturbed by prior mining. A 10-foot extraction thickness is assumed for mining in both the D seam and the B seam.

Table K-2 Maximum Tilt (M) (D seam=12 ft for Elk Creek Tract; D and B seams=10 ft for Iron Point Tract)					
Overburden Depth (ft)	Elk Creek Undisturbed (%)	Elk Creek Disturbed (%)	Iron Point Undisturbed (%)	Iron Point Disturbed (%)	Iron Point D & B Seams (%)
100-250	21.6 - 8.6	25.2 - 10.1	18.0 - 7.2	21.0 - 8.4	39.0 - 15.6
250-500	8.6 -4.3	10.1 - 5.0	7.2 - 3.6	8.4 - 4.2	15.6 - 7.8
500-1,000	4.3 - 1.8	5.0 - 2.0	3.6 - 1.7	4.2 - 1.9	7.8 - 3.6
1,000-1,500	1.8 - 0.8	2.0 - 1.1	1.7 - 0.9	1.9 - 1.0	3.6 - 1.9
1,500-2,000	0.8 - 0.4	1.1 - 0.5	0.9 - 0.5	1.0 - 0.5	1.9 - 1.0
2,000-2,500	0.4 - 0.2	0.5 - 0.2	0.5 - 0.1	0.5 - 0.3	1.0 - 0.4

7.3 Maximum Horizontal Strain

Maximum horizontal tensile and compressive strain (E, -E) is determined using local data that is compared to NCB (NCB, 1975) information. See *Figure K-4, Maximum Tilt and Strain.*

- Strain data are derived from the Somerset room-and-pillar mine, the West Elk longwall mine east of Somerset and the York Canyon longwall mine in New Mexico (Gentry and Abel, 1978). Horizontal strain is plotted in terms of the ratio of maximum vertical displacement to overburden depth (S/d) versus the ratio of mining panel width to depth (W/d).

- Horizontal tensile strain is projected by the author to range from 1.0 S/d for critical and supercritical mining panels to 1.25 S/d for subcritical panels, whereas compressive strain is projected to be -1.0 S/d for critical and supercritical mining panels to as much as -2.5 S/d for subcritical panels.

- Calculated maximum horizontal and compressive strain ranges (in percent; example: a horizontal strain of 0.036=3.6 percent=36,000 micro inches/inch) for the Elk Creek and Iron Point Coal Lease tracts in *Table K-3, Maximum Horizontal Tensile Strain* and *Table K-4, Maximum Horizontal Compressive Strain*, below; for the Elk Creek Lease Tract, mining panel width (W) equals 800 feet and maximum coal extraction thickness (t) equals 12 feet; for the Iron Point Coal Lease Tract, W = 900 feet and t = 10 feet for both the D and B seams.

- Maximum horizontal tensile and compressive strain in the first four columns of *Table K-3, Maximum Horizontal Tensile Strain* and *Table K-4, Maximum Horizontal Compressive Strain*, are given for D seam mining only in the Elk Creek and Iron Point Coal Lease tracts using maximum vertical displacement values of *Table K-1, Maximum Vertical Displacement.*

- Maximum horizontal tensile strain above large barrier pillars planned between panel groups in the Elk Creek Coal Lease Tract will likely be twice the amount shown on *Table K-3, Maximum Horizontal Tensile Strain*, because (as with tilt) the overburden and surface will subside both ways above these rigid barriers, and therefore double the tilt and horizontal tensile strain.

- Tensile and compressive strains in column 5, *Table K-3, Maximum Horizontal Tensile Strain* and *Table K-4, Maximum Horizontal Compressive Strain*, are given for mining both the D seam and the B seam in the Iron Point Coal Lease Tract, assuming that D seam mining is in

undisturbed ground and, of course, subsequent B-seam mining is in disturbed ground. Add 10 percent to the values in column 5 if D seam mining is in ground disturbed by prior mining. A 10-foot extraction thickness is assumed for both D seam and B seams mining in the Iron Point Coal Lease Tract.

Table K-3
Maximum Horizontal Tensile Strain (E)
(D seam=12 ft for Elk Creek Tract; D and B seams=1- ft for Iron Point Tract)

Overburden Depth (ft)	Elk Creek Undisturbed (%)	Elk Creek Disturbed (%)	Iron Point Undisturbed (%)	Iron Point Disturbed (%)	Iron Point D & B Seams (%)
100 - 250	7.2 - 2.9	8.4 - 3.4	6.0 - 2.4	7.0 - 2.8	13.0 - 5.2
250 - 500	2.9 - 1.4	3.4 - 1.7	2.4 - 1.2	2.8 - 1.4	5.2 - 2.6
500 - 1,000	1.4 - 0.6	1.7 - 0.7	1.2 - 0.6	1.4 - 0.6	2.6 - 1.2
1,000 - 1,500	0.6 - 0.3	0.7 - 0.4	0.6 - 0.3	0.6 - 0.3	1.2 - 0.6
1,500 - 2,000	0.3 - 0.15	0.4 - 0.2	0.3 - 0.2	0.3 - 0.2	0.6 - 0.4
2,000 - 2,500	0.15 - 0.1	0.2- 0.1	0.2 - 0.1	0.2 - 0.1	0.4 - 0.2

Table K-4
Maximum Horizontal Compressive Strain
(-E; all strain values in table are negative)

Overburden Depth (ft)	Elk Creek Undisturbed (%)	Elk Creek Disturbed (%)	Iron Point Undisturbed (%)	Iron Point Disturbed (%)	Iron Point D & B Seams (%)
100 - 250	7.2 - 2.9	8.4 - 3.4	6.0 - 2.4	7.0 - 2.8	13.0 - 5.2
250 - 500	2.6 - 1.3	3.4 - 1.7	2.4 - 1.2	2.8 - 1.4	5.2 - 2.6
500 - 1,000	1.3 - 0.7	1.7 - 0.8	1.2 - 0.6	1.4 - 0.6	2.6 - 1.2
1,000 - 1,500	0.7 - 0.5	0.8 - 0.6	0.6 - 0.4	0.6 - 0.5	1.2 - 0.9
1,500 - 2,000	0.5 - 0.3	0.6 - 0.3	0.4 - 0.3	0.5 - 0.3	0.9 - 0.6
2,000 - 2,500	0.3 - 0.15	0.3 - 0.2	0.3 - 0.2	0.3 - 0.2	0.6 - 0.4

7.4 Draw Angle (limit angle, angle of draw)

The draw, or limit angle (ϕ), defines the limit of subsidence at the surface in relation to a given mining panel at depth. Therefore, by projecting a series of straight lines (or planes) from around the edges of a given mining panel to the surface, the surface area affected by extracting the coal in the panel can be determined.

- As previously mentioned, the draw angle for room-and-pillar and longwall mines in the Somerset area ranges between 8 and 21 degrees (Dunrud, 1976, p. 22-23). The draw angle at the West Elk longwall mine ranges from 9 to 18 degrees. The draw angle (vertical reference) is therefore projected to be between 10 and 20 degrees, with an average of about 15 degrees.

- The well-accepted practice in subsidence analysis is to use the local range of values for angle of draw. According to Briggs (1929, p. 22, in Dunrud, 1998, p. 101) the attitudes of

faults and joints can influence the angle of draw significantly. The angle of draw commonly is increased where the angles of faults and joints are less than the angle of draw, whereas, the angle of draw often is decreased where the angles of faults and joints are greater than the angle of draw. Only steeply-dipping to vertical faults and joints were mapped in the Somerset-Paonia area, which includes the Somerset Mine, the West Elk Mine, and the Elk Creek and Iron Point Coal Lease tracts (Dunrud, 1989). The steeply-dipping structural features likely are a major reason why the range in angles of draw measured for both room-and-pillar and longwall mines is 8 to 21 degrees.

- At the permitting stage, a 25 degree angle of draw is used at the West Elk longwall mine in determining projected mine boundaries relative to permit boundaries. Although the measured values of angle of draw are 9 to 18 degrees, this ultra-conservative value is used to establish a buffer zone between the mine boundaries and permit boundaries. The 25 degree angle of draw should perhaps also be used in the Elk Creek and Iron Point Coal Lease tracts as an ultra-conservative value for establishing mine boundaries and permit boundaries.

- Although the draw angle defines the limit of surface subsidence, the break angle, as discussed next is perhaps more important in a subsidence analysis where hydrologic impacts are of particular importance.

7.5 Break Angle

The break angle (β) provides a means of defining the areas or zones of maximum tensile strain above a mining panel or superpanel, and therefore, defines zones of maximum hydrologic impact. Most cracks in the overburden and at the surface occur in zones of maximum tensile strain, and is therefore also the zone of greatest water conductivity.

- The break angle reportedly averages 10 degrees less (steeper angle) than the draw angle (Peng and Geng, 1982). Based on observations in the Somerset area, the break angle ranges from a few degrees from vertical, but averages about vertical (zero degree break angle). The presence of steeply-dipping to vertical joints in the Somerset-Paonia area may be a major factor controlling the nearly vertical attitude of the break angle.

- The location of zones of maximum hydraulic conductivity are both dynamic and static.

- The **dynamic zone** of fracturing is located above the longwall mining face and thus moves at the same velocity as the face. Therefore, these cracks tend to appear as the face moves beneath a point of observation, and then close again as the face moves out of the area of mining influence--a distance of 1.2 d to 1.4 d. Measurements by DeGraff and Romesburg (1981), on surface bedrock above room-and-pillar coal mines in Utah, showed that these cracks healed as mining was completed in the area.

- The **static zone** of fracturing occurs above mining panel boundaries and rigid gate road pillars and barrier pillars. These cracks are likely located in a 100-foot zone above panel boundaries and also in a 150 to 200-foot zone above gate road pillars between the panels and barrier pillars between panel groups. In a superpanel configuration, most cracks within will likely heal and seal again. In the Somerset area, cracks in this static zone commonly remain open until the forces of weathering, mass wasting, and erosion fill them in. The author observed complete healing and sealing of weathered shales and siltstone in about 10 years after coal was mined by room-and-pillar methods in the Somerset area. The same concepts and time frame should apply to longwall mining methods.

- The maximum projected depth of cracks in the continuous deformation and near-surface zones is a function of the thickness of the material behaving as a plate (beam in two dimensions) as shown in *Figure K-2, Typical Longwall Subsidence Cross-Section.* Under conditions of lateral constraint, as in the valleys and other areas of gentler relief, cracks will not likely propagate further than the location of the neutral surface of the material. Cracks wider than a few inches and deeper than 10 to 20 feet are estimated to be rare in these areas.

- As discussed earlier in Section 5.1, Rugged Terrain, cracks on ridges and near steep valley walls and cliffs are projected to be considerably wider and deeper than in the valleys, because lateral constraint is greatly reduced compared to the valleys.

7.6 Rate and Duration of Subsidence

Subsidence at a given point on the surface begins when the longwall face is beneath that point, is 50 percent complete when the longwall face is 0.3 to 0.4 times the overburden depth (0.3-0.4 d) beyond the point, and is more than 90 percent complete when the longwall face has passed 1.2d to 1.4d beyond the given point.

- Subsidence rate, duration, and attendant impacts are therefore a function of mining rate. The faster and more uniformly longwall mining is accomplished, the less time any fractures occurring in the dynamic zone will be open. Any fractures present in the static zone will, of course, remain open after mining is finished and until filling, healing, and sealing processes are complete.

- Dynamic tilt and horizontal strain reportedly decrease with increasing speed of longwall extraction (Peng, 1992, p. 20-21). For example, as the rate of movement of the longwall face in a West Virginia coal mine increased from 10 feet/day to 40 feet/day:

  1. Maximum dynamic tilt decreased an average of 42 percent.

  2. Maximum dynamic tensile strain decreased by an average of 22.5 percent.

  3. Maximum dynamic compressive strain decreased by an average of 48 percent.

8.0 IMPACTS OF SUBSIDENCE ON STRUCTURALLY SENSITIVE AREAS

8.1 Longwall Mining in Geologic Hazard Areas of Landslides, Rockfalls, and Unstable Slopes

These unstable areas occur naturally, but may be impacted by mining activities.

- It is therefore important to have baseline data and an inventory of all landslide, rockfall, and generally unstable areas before mining begins, so that movements due to natural processes can be excluded from any potential mining impacts. See *Figure 11, Geologic Hazards Map*, in the attached EIS figure volume.

- It is also important to have an assessment plan to distinguish between mining-related impacts on unstable areas and other activities, such as road construction. An example of this is the large landslides that occurred during and after construction of State Highway 133 on the south side of the North Fork of the Gunnison River between the West Elk Mine and Paonia Reservoir. No mining had yet been done in this area.

- Tilt and strain caused by subsidence may accelerate movement in landslide and rockfall areas - areas where movements would eventually occur due to natural causes. This is most likely on steeper slopes during periods of increased precipitation.

- Large tilt and horizontal strain values caused by longwall mining in shallow overburden, such as mining close to the coal outcrop may cause the greatest mining impacts on areas that are already unstable.

    1. Tilt values greater than about 5 to10 percent (250 to 500-foot overburden depth or less) may impact areas that are already prone to landslides or rockfalls, particularly where the tilt direction parallels the downslope direction, and therefore increases the slope by the tilt amount.

    2. The stability of geologic hazard areas may also be increased by subsidence, where the subsidence-induced tilt direction is opposite to the topographic slope direction. In this instance, the slope angle would be decreased by the amount of the subsidence-induced tilt value.

    3. Horizontal tensile strain values greater than about 2 to 3 percent (250 to 500-foot overburden depth or less) also may accelerate the natural landslide or rockfall process, particularly during periods of high or increased precipitation.

8.2 Mining Beneath Streams

As discussed previously in Section 6.1.4, pillars were extracted during the mid-1970s beneath Bear Creek without any observed temporary or permanent impact on stream flow.

- Pillars were extracted in a panel 400 to 460 feet wide located 220 to 300 feet (average of about 260 feet) beneath Bear Creek. The pillars in a zone 350 feet wide beneath Bear Creek were only partially extracted. The remaining pillars on either side of this zone were completely extracted. The original pillar dimensions were 60 feet square. Two adjacent sides of each pillar in the zone were further mined, so that the remaining pillars measured 30 to 35 feet on a side.

- Vertical displacement, tilt, and strain cannot be accurately calculated, because of the uncertainty of yield values of the small pillars left under Bear Creek. However, based on the size and length of the cracks observed in the area (described in Section 6.1.4, Near-Surface Zone), the area above these small pillars very likely was subject to maximum tilt and horizontal strain projected for the 250 to 500-foot overburden depth category in the Elk Creek and Iron Point Coal Lease tracts (*Table 2-4, Summary of Impacts by Alternative for Each Issue*).

- It is very important to note that there was no observed or reported impact on stream flow in Bear Creek due to the subsidence in the mid-1970s to the present time.

8.2.1 Driving Entries Beneath Terror Creek

Five entries may be driven in the B seam under Terror Creek near the southwest part of the Iron Point Coal Lease Tract. These entries would be used to provide mining access and haulage to a lease tract west of Terror Creek (known as Bowie No. 1 Pod). This analysis examines the impacts if no extraction of pillars under Terror Creek occurs. Only five entries 20 feet wide, 10 feet high, and square pillars on a minimum of 75-foot centers will be driven. When subsidence must be avoided under drainages,

pillars must be much larger than normally used in room-and-pillar mining, thus minimizing or preventing their failure.

- The following tilt and horizontal tensile and compressive strain can be projected for these entries, first by using the subsidence prediction methods for the Elk Creek and Iron Point Coal Lease tracts and second, by analyzing the stability of the pillars in the five-entry system with a widely accepted procedure.

First, subsidence will be determined above the individual entries (i. e. the entries will be considered separately), as follows: the overburden depth ranges from 300 to 600 feet (use 300 feet to be conservative) where the entries are planned. The planned mining width is 20 feet, the coal extraction thickness (t) is 10 feet. The mining width to depth ratio (W/d) equals 20/300 = 0.067; Maximum predicted vertical displacement (*Figure K-3, Maximum Vertical Displacement for Longwall*) is 0.025 t

- Maximum tilt is thus determined to be: 1.0 x 0.025 x 10 feet/300 feet =0.25/300 = 0.00083 = 0.08 percent. See *Figure K-4, Maximum Tilt and Strain.*

- Maximum horizontal tensile strain equals 0.5 x 0.025 feet x 10 feet/300 feet = 0.125 feet/300 feet = 0.00042 = 0.04 percent.

- Maximum horizontal compressive strain equals -2.5 x 0.025 x 10 feet/300 feet = 0.625 feet/300 feet = -0.0021 = -0.21 percent

- The impact predicted for driving five 20-foot entries beneath Terror Creek at a 300-foot depth, using this separate entry concept, seems negligible. Maximum tilt and horizontal strain values are lower than those projected for the 2,000 to 2,500 feet overburden depth category for horizontal compressive strain. Of course no cracks would occur in areas undergoing compressive strain.

Second, the potential impact of driving five entries beneath Terror Creek will be determined by considering the mine entries as an interrelated system of mine openings separated by coal pillars. Under this procedure, the capability of the pillars to support the overburden weight will be evaluated and analyzed, using the same entry width as before, but maximum overburden depth to be conservative. Subsidence will then be determined based on the projected yield of the pillars due to stresses produced by the weight of the overburden.

Average vertical stress on each pillar in the entry system was calculated by Bowie Resources using the Analysis of Longwall Pillar Stability (ALPS) program provided to them by the National Institute for Safety and Health (NIOSH). The input parameters to the ALPS program were:

1. Seam thickness - 10 feet,

2. Overburden depth - 600 feet (most conservative),

3. Entry width - 20 feet,

4. Crosscut centers - 75 feet (minimum dimension; may be 100 feet),

5. Entry centers - 75 feet (minimum dimension; may be 100 feet),

6. In-situ coal strength - 900 pst (accepted value-based on nation-wide pillar-stability studies),

Using the ALPS program originally developed by the US Bureau of Mines, a factor of safety of 1.88 is calculated. A factor of safety of 1.3 indicates that no pillar yield will occur. The 1.9 factor of safety indicates that no pillar yield will occur, and therefore no vertical displacement, tilt, and horizontal strain due to pillar yield will occur.

- The long-term stability of the five-entry accessway under Terror Creek should also be considered at the permit stage prior to mining. Periodic monitoring of the ground surface may be necessary to verify long-term stability of the access entries.

8.3 Driving Entries Beneath the Curecanti-Rifle 230/345 kV Powerline

No impact to the powerline is anticipated due to driving entries beneath the powerline. Maximum tilt and horizontal tensile and compressive strain values caused by driving five entries beneath Terror Creek are projected to range from 0.08 percent (tilt) and 0.04 percent (horizontal tensile strain) to -0.21 percent (horizontal compressive strain) above each entry, using the most conservative input parameters for the subsidence calculation.

- Also, pillar stability analysis of the five-entry system shows that no pillar yield will occur, and therefore, vertical displacement, tilt, and strain due to driving the entries equals zero.

- The long-term pillar stability of the Bowie mine access entries as outlined in the last part of Section 8.2.1, Driving Entries Beneath Terror Creek, should also be evaluated in a similar manner for the Curecanti-Rifle 230/345 kV powerline right-of-way.

8.4 Longwall Mining Beneath Terror Creek Reservoir

The potential impact of mining beneath Terror Creek Reservoir, which the author has been asked to assess, will only be fully known when all site-specific geologic information about dam and reservoir stability and source of water is known. However, maximum tilt and horizontal tensile and compressive strain can be projected for the reservoir area based on calculations for the Iron Point Coal Lease Tract as it currently exists.

- The Terror Creek Reservoir is located north of the currently projected Iron Point Coal Lease Tract. The overburden depth, relative to the B and D seams, ranges between 2,000 and 2,500 feet. Maximum tilt (M) and horizontal strain (E, -E) values due to longwall mining 10 feet of coal in the D seam in undisturbed ground, followed by mining 10 feet of coal in the B seam in disturbed ground (longwall panel width - 900 feet), are determined, as follows (note: because the Terror Creek Reservoir is located on a broad ridge, maximum vertical displacements for undisturbed ground and disturbed ground will be used from *Figure K-3, Maximum Vertical Displacement for Longwall Mines*; a sample calculation is given for maximum tilt):

    1. **D seam-d=2,000 feet:** M = (3.5)(0.30x10 feet)/2,000 feet = 10.5/2,000 feet = 0.00525 = 0.52 percent
       D seam-d=2,500feet: M = (3.25)(0.2x10 feet)/2,500 feet = 6.5/2,500 feet = 0.0026 = 0.26 percent
       M ranges from 1.2 percent (d=2,000 feet) to 0.5 percent (d=2,500 feet) for mining both D and B seams.

    2. E ranges from 0.2 to 0.1 percent for mining the D seam; E from 0.4 to 0.2 percent for mining both D and B seams.

3. -E varies from -0.3 to -0.2 percent for mining the D seam: -E from -0.7 to -0.4 percent for mining both D and B seams.

- Tilt and strain amounts projected for the Terror Creek Reservoir are the maximum static strains that would occur above the mine boundary areas. Cracks as much as an inch wide (and of unpredictable length) are projected to occur in the massive Ohio Creek sandstone if the D seam is mined. Cracks as much as 2 inches wide are projected if both seams are mined. These cracks are predicted because lateral constraint is significantly less in this ridge area than it would in valleys.

- If a longwall panel were designed so that the reservoir would be above the panel center, then it would be subjected to only the temporary, dynamic tilt and strain during mining, and therefore the impact would be significantly less than if impacted by the static tilt and strain above mine panel boundaries.

8.4.1 Options in Regard to Mining in the Area of the Terror Creek Reservoir

Terror Creek Reservoir is outside any proposed lease tract boundary. However, to address issues raised during EIS scoping, three options were considered with regard to mining in the area of the Terror Creek Reservoir. These options would be to:

- Mine only to a buffer zone that would be designed to protect the dam, reservoir, and water source from any possible subsidence impacts.

- Mine only the D seam beneath the reservoir.

- Mine both the D and B seams beneath the reservoir.

Option 1, leave an adequate buffer zone to protect the reservoir. The first step under this option would be outline the buffer area that involves the dam abutments, the reservoir, and the water source area. The second step is to calculate the buffer distance around this area that could not be impacted under this option, using conservative angles of draw.

- Angles of draw are projected to range from 10 to 20 degrees in the Iron Point Coal Lease Tract, with a projected average of 15 degrees. However, in establishing an adequate buffer zone, conservative values greater than 15 degrees should perhaps be used. *Table K-5, Buffer Distance Outward From Impacted Reservoir and Water Source Area*, indicates the buffer distance outward from the limits of the impacted area for various angles of draw.

The buffer zone calculated around the outward limits of the dam and reservoir, using a 25 degree angle of draw is the ultra-conservative value used at the mine permitting level in the similar geologic environment at the West Elk Mine (oral communication, West Elk Mine personnel, 1999). No angle of draw greater than 18 degrees has been measured at the West Elk Mine; therefore, 25 degrees should be very adequate.

Option 2, Mine only the D seam beneath Terror Creek Reservoir. Under this option, maximum tilt and horizontal strain values range from 0.5 percent (for d=2,000 feet) and 0.3 percent (d=2,500 feet) for tilt; 0.2 (d=2,500 feet) to 0.1 percent (d=2,500 feet) for horizontal tensile strain; -0.3 to -0.2 for horizontal compressive strain. Cracks of as much as 1 inch may occur above mine boundaries in the upper Ohio Creek sandstone of the Mesaverde Formation.

Option 3, Mine both the D seam and the B seam beneath Terror Creek Reservoir. Maximum tilt and horizontal strain under this option are calculated to range from 1.2 percent (d=2,000 feet) to 0.6

percent (d=2,500 feet) for tilt; 0.4 percent (d=2,000 feet) to 0.2 percent (d=2,500 feet) for horizontal tensile strain; -0.7 percent (d=2,000 feet) to -0.4 percent (d=2,500 feet) for horizontal compressive strain. Cracks as much as 2 inches wide may occur above the mine boundaries in the Ohio Creek sandstone.

- Under options 2 and 3, detailed studies and tests should be done in the reservoir site area to determine how the maximum tilt and strain projected for the site would impact stability, and also how seismic events up to about 4.0 on the Richter scale (based on measurements made by Arabasz and others [1997] at longwall mining operations in Utah) would impact stability. Modeling studies may also be needed. The following suggestions may be useful to the studies (there may be others):

1. Determine dam stability before mining and after mining the D and then the B seams. Also determine the geologic and geotechnical characteristics of the material with which the dam was constructed.

Table K-5
Buffer Distance Outward From Impacted Reservoir and Water Source Area

Depth of Coal (feet)	Angle of Draw (Degrees)	Buffer Distance (feet)
Relative to the D seam		
2,000 - 2,500	10	353 - 441
2,000 - 2,500	15	536 - 670
2,000 - 2,500	20	728 - 910
2,000 - 2,500	25	933 - 1,166
2,000 - 2,500	30	1,155 - 1,433
Relative to the B seam (using 275 feet vertical separation between the top of the B seam and the top of the D seam)		
2,275 - 2,775	10	404 - 489
2,275 - 2,775	15	610 - 744
2,275 - 2,775	20	828 - 1,010
2,275 - 2,775	25	1,060 - 1,294
2,275 - 2,775	30	1,314 - 1,602

2. Determine dam stability before mining and after mining the D and then the B seams. Also determine the geologic and geotechnical characteristics of the material with which the dam was constructed.

3. Determine reservoir stability before and after mining the D and then the B seams. Also determine the geological and geotechnical characteristics of the material on which the dam is founded.

4. Determine the source of water: Is it from (a) near the base of the Wasatch Formation or (b) the top of the Mesaverde Formation (Ohio Creek sandstone). The author noted a permeable cobble/gravel zone near the base of the Wasatch Formation in some areas during geologic mapping of the area. Should this be the source of water, it would be

important to determine whether clays occur beneath this zone, or if this zone rests on top of the Ohio Creek sandstone.

- Subsidence impacts would be greatest if the source of water occurs in a gravel/cobble zone resting directly on top of the Ohio Creek sandstone, or if the source of water is at the top of the Upper Ohio Creek sandstone. Subsidence impacts would be significantly less if a clay layer (perhaps 10 to 20 feet thick) occurs between the water source and the Ohio Creek sandstone.

- With detailed, site-specific knowledge of the reservoir site (including the dam, reservoir foundation, and location of the water source) and proper orientation of the mining panels, it may be possible to mine under Terror Creek Reservoir in the D seam, and perhaps even the B seam, if the highly yieldable claystones 15 feet or more thick occur beneath the dam, reservoir, and water source. Of course, this would depend on the results of a detailed geologic, geotechnical, and modeling evaluation of the general reservoir site and the site response to local seismic activity on the order of 4.0 on the Richter scale.

9.0 STOPING (PIT SUBSIDENCE/CHIMNEY SUBSIDENCE)

In contrast to the downwarping (trough subsidence), stoping consists of successive collapse of the mine roofs (Piggot and Eynon, 1978). The mine openings move upward as the roof rocks collapse and the caved material falls on the floor.

Caving (stoping) geometry may take the form of a prism, a cylinder, an ellipsoid, a wedge, or a cone (Dunrud, 1984, p 159-160). The maximum height on caving is function of the coal extraction thickness and the bulking factor for the various caving geometries.

Based on the caving geometries and bulking factors observed by the author in the coal fields of Wyoming (Dunrud, 1980), the maximum height of chimney subsidence in dry environments ranges between 10 and 15 times the coal extraction thickness (10 to 15t). Using the worst-case conical caving geometry and a bulking factor of 0.2 (20 percent), the maximum height of stoping failure would be:

1. 180 feet for the Elk Creek Coal Lease Tract (15 x 12 feet).
2. 150 feet for the Iron Point Coal Lease Tract (15 x 10 feet).

A minimum mining overburden limit on the order of 150 to 200 feet for the Elk Creek and Iron Point Coal Lease tracts, respectively, would reduce the chance of chimney subsidence at the surface, unless water flow transported the caved material out of the cave area, or water softened the caved rocks (such as claystones and shales) and produced a bulking factor less than 0.2 (20 percent).

10.0 GAS OUTBURSTS

Gas outbursts are the sudden, and sometimes violent, release of methane (or occasionally carbon dioxide) together with broken coal fragments from mining faces. Outbursts commonly occur where the coal contains large amounts of gas under high pressure. The pressure may be caused by high overburden stresses, where the overburden depth is more than 2,000 to 2,500 feet and/or where igneous intrusive bodies, channel sandstones, or faults cause local elevated stress conditions

The outburst potential for the Elk Creek and Iron Point Lease tracts, in the author's opinion, seems low for most areas in the two lease tracts below the 2,000-foot overburden depth limit.

- The gas outburst potential probably is in the low to moderate category in the 2,000 to 2,500-foot overburden depth range where the rocks are not faulted.

- The potential, however, may range from moderate to high where faults, igneous bodies, and/or channel sandstones are present and where the overburden depth is greater than 2,000 feet.

- The outburst potential may be high near the Iron Point intrusive body in the Iron Point Coal Lease Tract above an overburden depth of 1,500 feet.

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Appendix L

Socioeconomic Report

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SOCIOECONOMIC REPORT

Note: Figures associated with this appendix can be found in the EIS Figure Volume.

1.0 SOCIOECONOMICS

This report provides an overview of the socioeconomic aspects of the existing conditions of the area, as well as the impacts associated with pending decisions on the proposed Iron Point and Elk Creek Coal Lease Tracts.

For purposes of the socioeconomic assessment, primary, secondary, and tertiary study areas are defined see Figure L-1. Socioeconomic Study Areas:

- The primary study area is the geographic area that is anticipated to be most directly affected by the proposed project. The primary study area is defined to include all communities within Delta County. This is expected to be the primary area where most mine related effects are experienced, based in large part on residence locations of mine-related employees.

- The secondary study area is the geographic area expected to be indirectly affected by the proposed project. The larger secondary study area includes all of Delta and Gunnison Counties. Gunnison County may also experience direct fiscal effects. Other Gunnison County direct effects will be focused largely in the unincorporated area of Somerset due to the geographic location of the mines away from other Gunnison centers of population.

- The tertiary study area covers the even larger geographic area –expected to experience broader cumulative social effects due to the proposed project. Economic and social changes in the tertiary area also provide a context for other non-mine related changes occurring in the primary and secondary study areas. For this analysis, the tertiary study area is defined to include the seven-county Central Western Slope area of Delta, Gunnison, Mesa, Montrose, Ouray, Pitkin, and San Miguel. This broader study area will be denoted as the Central Western Slope area.

2.0 AFFECTED ENVIRONMENT

This section discusses current and historic trends that influence study area population. The evaluation of the affected population defines existing conditions. Information presented in this section is used to assess the effects of different mine development alternatives.

2.1 Population and Demographics

Information on population for the study areas has been compiled from a variety of sources beginning with the 1980 and 1990 U.S. Censuses. Updated estimates (since 1990) were obtained from the State of Colorado Demography Section and U.S. Census Bureau.

As of 1998, approximately 26,600 residents live in Delta County, the primary study area. Population has increased by 3% annually since 1990. This rate of growth is faster than the rate of growth occurring in the broader secondary and tertiary study areas as well as statewide. A large portion of primary study area population growth experienced since 1990 has occurred in the City of Delta (35%).

The City of Delta is the largest incorporated community in the primary study area with 5,600 residents residing within the city limits, 21% of all residents living in the primary study area. After Delta, the next largest cities are Orchard City, Cedaredge, Paonia, Hotchkiss and Crawford, respectively. Together, the incorporated communities within the primary study area account for nearly 50% of total Delta County population.

Table 1. Population Trends (1980-1998)

Geographic Area	Total Population 1980	1990	1998	Annual % Change 80-90	90-98
Cities/Towns:					
Cedaredge *	1,184	1,380	1,920	1.5%	4.2%
Crawford *	268	221	280	-1.9%	3.0%
Crested Butte	959	878	1,130	-0.9%	3.2%
Delta *	3,931	3,654	5,600	-0.7%	5.5%
Gunnison	5,785	4,636	5,195	-2.2%	1.4%
Hotchkiss *	849	744	915	-1.3%	2.6%
Marble	30	64	85	7.9%	3.6%
Mount Crested Butte	272	336	365	2.1%	1.0%
Orchard City *	1,914	2,218	2,805	1.5%	3.0%
Paonia *	1,425	1,403	1,765	-0.2%	2.9%
Pitkin	59	53	205	-1.1%	18.4%
Subtotal Study Area Cities	16,676	15,587	20,265	-0.7%	3.3%
Delta County	21,225	20,980	26,619	-0.1%	3.0%
Gunnison County	10,689	10,273	12,456	-0.4%	2.4%
Subtotal Delta + Gunnison	31,914	31,253	39,075	-0.2%	2.8%
Central Western Slope	153,251	167,430	204,903	0.9%	2.6%
State of Colorado	2,889,735	3,294,473	3,970,971	1.3%	2.4%

* Note: Cities in primary study area.

Source: E.D. Hovee & Company using information provided by U.S. Census Bureau.

The two-county secondary study area has a combined population of 39,075 as of 1998. The majority (or 68%) of the population lives in Delta County. Secondary study area population has increased at an average rate of 2.8% annually since 1990, with the greatest increase between 1993-1995.

According to data provided by Oxbow, West Elk, and Bowie mine operators, as well as severance tax data, an estimated 88-96% of Bowie, Oxbow (Sanborn), and West Elk mine employees live in Delta County.[1] Over 56-67% live in the Paonia/Hotchkiss area. Only a small proportion (4-12%) live outside of Delta County. Most of these workers live in the Somerset area, a small unincorporated community just east of Paonia in Gunnison County.

[1] The range in the reported proportion of mine employees living in Delta County stems from the information reported by each information source. Bowie reported that 141 (or 88%) of its 160 mine employees live in Delta County. In contrast, West Elk reported that 274 (or 96%) of its 285 mine employees live in Delta County.

Table 2. Where Mine Workers Live

Community	Bowie	Oxbow	West Elk	Severance Tax
Cedaredge	9	16	11	6
Crawford	13	21	–	41
Delta	20	14	35	33
Hotchkiss	31	34	59	29
Orchard City	–	–	–	9
Paonia	59	74	132	138
Rest of Delta County	9	–	37	22
Total Delta County	141	159	274	278
Gunnison County (including Somerset)	1	7	11	16
Other Counties	18	11	–	–
Total All Workers	160	177	285	294

Source: Information provided by West Elk, Bowie, and Oxbow mines as well as state severance tax records. Severance tax data covers all coal mine employees living in Delta & Gunnison Counties.

Population changes in Delta County, as well as Gunnison County and statewide, are primarily driven by migration trends.[2] During most of the 1980s, Delta County lost population. Between 1983 to 1989, net out-migration averaged 415 people per year. The year of greatest net out-migration occurred in 1987, when 1,120 more residents left than moved to Delta County.

Beginning in 1990, Delta County started to attract a net inflow of new residents. Over the last eight years, an average of approximately 700 net new residents have moved into the study area each year. Between 1993 to 1995, the period of greatest population growth, the number of net new residents moving into Delta County occurred at an even higher level of 1,100 net new residents per year.

As is further detailed in the discussion of employment, changes in Delta County population tend to closely parallel changes in employment activity. Since 1980, the years of greatest population loss have occurred during periods of declining employment in Delta County. See Figure L-2. Net Migration Trends (1981-1998).

Between 1996 and 1997, approximately 2,320 new residents moved into Delta County.[3] Almost 30% came from other Central Western Slope counties, 80% of them from neighboring Mesa and Montrose counties. Another 25% of new residents came from other counties in Colorado. Of the 45% of new residents moving into Delta County from outside Colorado, most (57%) came from other western states

Approximately 1,970 residents left Delta County between 1996-1997. About 30% moved to other Central Western Slope counties; primarily to neighboring Mesa and Montrose counties. Another 27% moved to other Colorado counties.

The Colorado Department of Local Affairs forecasts that Delta County's population can be expected to increase by another 16,000 residents over the next 20+ years. This equates to an average growth rate of 2.2% annually, a rate of growth below what has occurred over the last eight years. Population in the secondary study area is forecast to grow at a similar rate annually (2.1%). (See Figure L-3. Population Forecast (1995-2020).)

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2 Detailed population growth data is only available at the county level.

3 Information reflects the latest data available from the Internal Revenue Service (IRS) which publishes county-to-county migration flow data based on annual federal income tax returns.

2.2 Housing

Current household size in the primary study area is 2.40 persons per household. Household size in the primary study area has been declining, a result of smaller households moving into the primary study area. See Figure L-4. Changes in Household Size (1990-1998).

Households in the two-county secondary study area are slightly smaller than primary study area households. Secondary study area households average 2.38 persons per unit. Household size in the secondary study area has also been falling.

In 1997, 347 single family homes were sold in Delta County, 176 fewer sales than in 1994. This decline in sales volume corresponds well with the slowing in net in-migration of new residents.

Average sales price of a single family home in Delta County varies by community, from $68,900 to $101,800. Highest priced homes can be found in the Cedaredge and Paonia areas. However, the reported average sales price in the Paonia area has declined from $139,900 in 1995 to $89,800 in 1997. Reduced sales prices also coincide with slowing net in-migration of new residents.

Table 3. Single Family Home Sales (1994-1997)

	Single Family Sales				Average Sales Price			
Community	**1994**	**1995**	**1996**	**1997**	**1994**	**1995**	**1996**	**1997**
Delta County:								
Cedaredge Area	118	148	96	83	$76,501	$94,646	$98,690	$101,800
Crawford Area	21	15	16	15	$70,944	$64,233	$71,050	$68,860
Delta Area	251	196	206	152	$59,098	$65,873	$73,330	$83,820
Hotchkiss Area	54	53	36	38	$72,993	$90,889	$94,260	$87,640
Paonia Area	79	81	58	59	$99,557	$139,883	$100,170	$89,810
County Total	523	493	412	347	$71,050	$89,310	$84,760	$88,910
Gunnison County:								
Town of Crested Butte	21	10	12	19	$251,776	$338,000	$274,906	$328,040
Gunnison Area	130	109	84	46	$89,159	$117,480	$141,035	$114,786
East River Valley	55	26	23	43	$181,395	$308,270	$284,338	$294,660
Other Rural Area	61	46	31	35	$77,010	$121,308	$133,887	$123,420
County Total	267	191	150	143	$118,170	$155,920	$172,240	$199,320

Source: Delta County Assessor and the Gunnison County Assessor's Office.

In the larger secondary study area, 490 single family homes were sold in 1997. The number of home sales declined (by 300) from 1994 to 1997, for similar reasons as in the primary study area.

Single family homes in Gunnison County are considerably more expensive than Delta County. Average sales price of a home in Gunnison County ranges from $114,800 to $328,000, with highest priced homes reported in the resort community of Crested Butte. Rapid price escalation is also occurring in the nearby East River Valley communities.

2.3 Demographic Characteristics

An estimated 11.7% of the residents living in the primary study area represent racial and ethnic minorities, above the secondary study area (at 9.9%), but well below statewide levels (at 21.0%). Hispanic residents represent the largest minority/ethnic group, accounting for 10.5% of

the Delta County population. See Figure L-3. Ethnic Background of Study Area Populations (1997).

Almost 19% of residents new to the primary study area since 1990 are minorities. The fastest-growing minority group is Hispanic, representing 16.9% of Delta County population growth experienced since 1990. See Figure L-6, Change in Ethnic Background of Study Area Populations (1990-1997).

Primary study area residents tend to be older than secondary study area residents. Almost 49% of primary study area residents are age 45 and older, compared to 41% in the secondary study area.

Rand McNally's *Places Rated Retirement Guide* rated Delta County in the top one-third of communities nationally for climate, housing, health care, personal safety, economics, and recreation. Locally and regionally an in-migration of retirees is being experienced, particularly of young retirees (residents age 45 to 64).[4]

The primary study area population is aging. Over 69% of the population growth in the primary study area comes from persons aged 45 and older. Seniors (65+) account for 23% of all new residents. Figure L-7, Population Age Characteristics (1997).

This trend is somewhat similar to secondary study area and statewide trends. Almost 60% of population growth statewide and 65% of growth in the secondary study area has consisted of residents aged 45 and older. However, only 11% of statewide growth has come from residents age 65 and older. See Figure L-8, Changes in Population Age Characteristics (1990-1997)

2.4 Employment

Participation in the Delta County labor force is well below participation rates in the larger secondary study area and statewide. In 1997, only 50% of the population age 16 and older in Delta County were employed or actively seeking employment. In the secondary study area, 60% of residents age 16 and older were employed or seeking employment. The two-county secondary study area's higher participation rate is due to the 78% rate being experienced in Gunnison County reflecting a much higher percentage of working age adults living in that county. The statewide labor force participation rate is 72%. See Figure L-9, Labor Force Participation Rate (1997).

Delta County's low labor force participation rate appears to be related to its relatively high proportion of retired residents. As mentioned earlier, 49% of Delta County's population is age 45 and older, and 23% is age 65 and older.

Historically, the unemployment rate in Delta County has averaged between 4.7% and 6.6%, higher than the statewide rate. However, changes in Delta County's unemployment rate have paralleled statewide labor trends, as has unemployment in the secondary study area. See Figure L-10, Unemployment Rate Trends.[5]

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4 Based on a socioeconomic profile prepared by Region 10, the economic and community development agency for Delta, Hinsdale, Gunnison, Montrose, Ouray, and San Miguel Counties.

5 Unemployment rates are often viewed as a useful indicator of local economic activity. However, unemployment rates do not necessarily provide a complete reflection of local economic vitality. Rural

As of April 1999, the unemployment rate in Delta County was 5.9%, more than twice the statewide rate of 2.7%. Local unemployment consistently runs about 1½-2 percentage points above the statewide average.

Over the last 16 years, the job base in Delta County has been more affected by cyclical changes in national and global economic conditions than the entire state. Between 1984 and 1987, Delta County lost over 1,900 jobs, one-third in agriculture and farm-related businesses. Since 1987, almost 3,500 net new jobs have been created; 28% in the service sector.

However, the extent of cyclical variation in Delta County is less severe than for the larger secondary study area. Gunnison County appears to experience more higher peaks and lower valleys in employment trends over time. See Figure L-11, Total Employment Trends (Part- and Full-Time Employees).

Delta County population migration trends appear to closely parallel employment growth trends. For example, years of greatest net out-migration coincide with years of significant job losses, illustrating that when Delta County loses jobs, local population growth tends to slow or decline. See Figure L-12, Delta County Employment Growth and Population Migration Trends.

As noted above, while employment growth can influence population, the reverse situation where population growth influences employment opportunity can also occur. Communities offering high quality of life may draw in-migrants who then support local retail and service businesses. Some in-migrants may bring independent wealth and existing business or start a business, further boosting the local economy.

In 1996, approximately 11,370 workers were employed in Delta County (including self-employed). Employment has increased by almost 27% since 1980. Fastest-growing industries include services (+98%), wholesale trade (+78%), and construction (+62%). The only industries reporting a decrease in employment are agriculture and farm (-20%), finance, insurance, and real estate (-23%), and mining industries (-65%).[6]

As of 1996, self-employment is estimated to represent the largest single job sector in Delta County. The number of non-farm self-employed workers increased by 21% between 1980 and 1996 in Delta County. Over 30% of all workers are self-employed (non-farm), a greater proportion than in the secondary study area or even statewide.[7]

Over the last 17 years the coal mining industry in Delta County, as well as in the secondary study area and statewide, has gone through a period of economic restructuring. In 1981, nine active

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communities that are particularly attractive for quality of life reasons may experience levels of unemployment that exceed statewide averages.

6 U S Bureau of Economic Analysis (BEA) employment figures for the mining industry are lower than employment levels reported by Bowie, Oxbow and West Elk mines, as well as levels reported through the state's severance tax program. However, BEA's employment data (with the inclusion of self-employed workers) presents the most comprehensive account of total employment.

7 During E.D. Hovee & Company's survey of area service providers, it was noted that U.S. West now provides three phones in most new houses due to a growing number of home occupation/home office customers. Furthermore, Delta Telecommunications reported that the number of business lines increased by 33% versus only 17% for residential lines. This trend is supportive of a shift toward small cottage, telecommuting, and other related self-employment related activities.

coal mines produced almost 3.0 million tons of coal in the secondary study area (covering Delta and Gunnison Counties), representing 15% of total production statewide. By 1986, only three active mines remained producing 1.3 million tons of coal, representing only 8% of statewide production.

Table 4. Employment Trends by Sector

Employment Sector	Delta County 1996	Delta County 1980-96	Delta + Gunnison Study Area 1996	Delta + Gunnison Study Area 1980-96	Colorado 1996	Colorado 1980-96
Agriculture & Farm*	1,616	-20.0%	1,950	-18.8%	68,108	+16.0%
Mining*	123	-65.4%	631	-41.5%	24,798	-42.8%
Construction	912	+61.7%	1,757	+64.8%	163,956	+60.0%
Manufacturing	591	+38.1%	868	+43.5%	211,252	+13.9%
TCPU	365	+3.1%	627	+32.6%	136,083	+60.8%
Wholesale Trade	391	+77.7%	493	+69.4%	108,661	+35.4%
Retail Trade	2,036	+44.6%	4,494	+64.4%	452,080	+64.5%
FIRE	687	-22.7%	1,463	-8.7%	202,364	+26.3%
Services	2,774	+98.4%	5,538	+102.3%	810,435	+118.6%
Government	1,872	+40.2%	3,306	+42.7%	354,377	+20.7%
Total Employment**	11,367	+26.7%	21,127	+38.0%	2,532,114	+53.1%
Self Employment						
Farm	843	-6.3%	983	-6.7%	24,274	-9.5%
Nonfarm	3,426	+21.3%	5,703	+37.7%	475,081	+82.6%

Notes: * Also includes wage and salary farm employment not otherwise included within the agricultural sector. Agriculture and mining employment was not disclosed in 1996 for Delta County. Mining employment was estimated using 1997 covered employment data from the State of Colorado. Agricultural employment is estimated as the difference between total non-disclosed employment and estimated mining employment.

** Self-employed workers are included within each employment sector.

Source: E.D. Hovee & Company using Bureau of Economic Analysis information.

The decline in coal production reportedly resulted from the elimination of federal energy tax credits and coal incentives and the related closure of US Steel's Somerset mine in 1985.[8] Between 1981-86, Delta County went from producing two-thirds of the secondary study area's coal to producing just over one-fourth.

Since 1986, the coal mining industry in the secondary study area has rebounded. However, the primary production of coal has shifted towards Gunnison County. For example, in 1997, 8.1 million tons of coal were produced, but only 804,000 tons came from Delta County mines. Also, the secondary study area is now producing almost 30% of the state's coal. See Figure L-13, Coal Production Trends (000s short tons).

The mines that survived the downturn of the mid-1980s have become more efficient and capital-intensive. While total coal production was declining between 1980 and 1986, production per worker steadily increased, primarily due to the closing of less efficient mines.

The amount of coal produced per worker increased dramatically over the last 17 years. In 1980, a total of 2,300 tons of coal was being produced per mine worker; by 1990, this had increased more than two-fold to almost 4,800 tons per worker. With the introduction of longwall technology, output per worker has increased even more substantially to 12,800 tons per worker.

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8 Western Slope Environmental Resource Council, *The Western Slope Environmental Report*, April 1999.

Added productivity has made it possible for existing mines to produce the same output with fewer employees. With longwall technology, the converse effect also is noted; more output often can be secured without the need for a corresponding increase in employment.

Longwall technology also has allowed the coal mines to recover a greater proportion of available coal. See Figure L-14. Coal Mining Productivity Trends.

The distribution of coal sales will vary over time depending on domestic and global market conditions. The geographic market for Colorado coal also is affected by transportation costs, with customers in nearby states typically representing major components of demand.

As of 1997, over 94% of the coal produced in Colorado was sold to domestic consumers in the United States (i.e. utilities, industrial plants, and households). About 45% of coal is sold in-state. Of the coal shipped out-of-state from Colorado mines, 12% is sold to consumers in Tennessee, 8% to Texas, 8% to Utah and 20% to other states. Less than 6% is exported, most of which is shipped to Mexico. See Figure L-15, Distribution of Colorado Coal Sales (1997).

In recent years, the price received from coal produced in Colorado has been on the decline, decreasing by an average of 2.4% per year. In 1993, Colorado coal mines received, on average, $20.35 per ton. By 1997, the average price of coal per ton was only $18.46. Reduced market pricing has placed greater competitive pressure on mine operators to focus on productivity improvements, including longwall technology. See Figure L-26, Average Mine Price of Colorado Coal.

In summary, both Delta and Gunnison Counties have experienced substantial employment growth in recent years from 1980-1996. This overall employment growth has occurred even as mining-related employment has declined, leading to a more diverse economy in both the primary and secondary study areas. While mine employment has declined, mines have restructured to achieve substantially greater productivity in a more competitive domestic and global market.

2.5 Income

In 1996, personal income per capita in Delta County averaged $16,400 (after adjusting for inflation), 4% below the $17,000 per person living in the secondary study area and 36% below $25,700 average experienced statewide.[9] Primary area personal income growth per capita has lagged behind per capita income growth in the secondary study area and the state as a whole. Between 1980 and 1996, personal income per capita in Delta County increased by only 19%, compared to 24% in the secondary study area and 33% statewide. See Figure L-17, Total Personal Income Per Capita (Inflation Adjusted).

In 1996, 43% of personal income in Delta County was derived from earned income sources (wages and salary, proprietor's income, and other labor income), down from 52% in 1980. As of 1996, residents in Delta County earn less in wages, salary and proprietor's income than from transfer payments (e.g., retirement, unemployment insurance, government payments) and investment income. Only 32% of personal income is from wage and salary sources, down from 36% in 1980.

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[9] Personal income is the amount of income an individual receives annually before taxes. It includes wages, salaries, proprietors' land other labor income; investment income; and transfer payments.

The total amount of transfer payment income received by Delta County residents doubled (after adjusting for inflation) between 1980 and 1996. Because the amount of income an individual (or household) receives from transfer payments tends to be less than could be earned from labor, the rapid growth in transfer payment income compared to earned income has tended to dampen the level of income growth experienced in Delta County compared to the larger secondary study area and entire state. See Figure L-18, Sources of Personal Income.

Earned income in the secondary study area and statewide also accounts for a declining share of personal income. However, earned income still represents the majority (54%) of total personal income in the secondary study area and 70% of total personal income statewide.

In 1996, average wage per worker in Delta County was only $15,700 compared to $17,100 in the entire secondary study area and $28,400 statewide. Highest-paid wages were in the mining sector where the average Delta County worker earned $47,600, more than three times the county wage average for all sectors and $18,400 above the next highest paying sector.

Most rapidly increasing wage levels in Delta County are in finance, insurance and real estate (+57.8%) and government (+14.9%); a trend also being experienced in the secondary study area and statewide. However, average wage for finance, insurance and real estate workers is only $11,100, second lowest paying sector in Delta County.

Table 5. Average Wage per Worker by Sector (inflation adjusted)

Employment Sector	Delta County 1996	Delta County 1980-96	Delta + Gunnison Study Area 1996	Delta + Gunnison Study Area 1980-96	Colorado 1996	Colorado 1980-96
Agriculture & Farm*	$6,100	+1.5%	$5,500	-19.6%	$16,300	+36.5%
Mining*	$47,600	-15.4%	$53,300	+6.4%	$52,500	-4.8%
Construction	$19,400	-23.1%	$22,100	-11.5%	$31,600	-7.3%
Manufacturing	$17,600	-13.0%	$17,000	-15.2%	$40,900	+11.1%
TCPU	$29,200	-7.3%	$26,100	-15.7%	$50,700	+19.8%
Wholesale Trade	$18,800	-6.2%	$19,500	-13.8%	$39,400	+6.6%
Retail Trade	$12,000	-20.1%	$12,000	-15.2%	$15,600	-8.4%
FIRE	$11,100	+57.8%	$14,300	+71.4%	$27,600	+60.8%
Services	$13,600	-8.7%	$14,200	-2.5%	$25,500	+16.3%
Government	$24,700	+14.9%	$25,400	+9.8%	$31,300	+22.7%
All Sectors**	$15,700	-4.9%	$17,100	-5.2%	$28,400	+9.1%
Self Employment (Nonfarm)	$10,800	-19.6%	$11,800	-11.8%	$17,800	-2.8%

Notes: * Also includes wage and salary farm income not otherwise included within the agricultural sector. Agriculture and mining income were not disclosed in 1996 for Delta County. Mining income was estimated using 1997 covered employment data from the State of Colorado. Agricultural income is estimated as the difference between total non-disclosed income and estimated mining income.

** Self-employment income is included within each employment sector.

Source: Bureau of Economic Analysis.

Delta County is attracting a net inflow of new residents. Between 1996-1997, a net 350 new residents moved into Delta County.[10] New residents moving into Delta County have higher incomes than those moving out. Median income of new residents averages $18,500 compared to an average median income of $14,500 for residents leaving the county.

[10] Information reflects the latest data available from the Internal Revenue Service (IRS), which publishes county-to-county migration flow data based on annual federal income tax returns.

2.6 Community and Public Services

As part of the EIS process, area community and public service providers have been contacted to ascertain information regarding current services provided together with possible public service effects due to prospective changes in mining activities in the Bowie and Somerset areas of Delta and Gunnison Counties. This assessment of possible impacts on community and public services focuses on the primary study area in Delta County, where the bulk of mine employees currently resides.

Representatives of the following community and public service providers were contacted:

- County and municipal governance
- Education
- Ambulance services
- Fire services
- Law enforcement
- Water supply, wastewater treatment and solid waste
- Hospital and medical services
- Electrical utilities
- Social services
- Roads

2.6.1 County and Municipal Governance

The primary study area consists of six incorporated communities, with the rural unincorporated portion of Delta County under the auspices of county government. The Bowie and Oxbow mines are situated in unincorporated Delta County, though a portion of Oxbow operations extend into unincorporated Gunnison County.

Delta County is governed by a three-person elected board of commissioners. Administrative functions are overseen by a non-elected county administrator. Each of the incorporated communities is governed by an elected mayor and city council, except for the City of Delta which has a council-manager form of government.

Gunnison County comprises five incorporated jurisdictions, none of which is closer than 34 miles (Town of Marble) to the Bowie or Oxbow mines. The unincorporated area (including the community of Somerset) is governed by the three-person elected Gunnison County Board of Commissioners.

Delta County's master plan divides the county into seven areas based on watersheds and the communities within each respective watershed. A committee in each planning area is charged with reviewing applications, identifying issues, and establishing standards and regulations.[11]

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[11] According to county officials, the fundamental mission of Delta County planning is to protect area resources. Water is considered a particularly important resource, so regulating subdivisions and mobile home parks are particular focuses for the committees.

Delta County has few provisions for planning, land use or local review of construction projects and development. For example, no building permits are required for the county's unincorporated area.

Only two of the incorporated communities within the primary study area of Delta County (Paonia and Delta) have an adopted zoning ordinance. Responsibility for land use planning resides in an appointed planning commission which serves in an advisory capacity to the elected city council.

Gunnison County does not have an adopted zoning ordinance covering unincorporated portions of the county. However, the unincorporated areas are governed by a land use resolution. The resolution allows only single family residential. All other uses are reviewed by the Planning Commission on a case-by-case basis. Recommendations are sent to the County Commissioners for a final approval. The unincorporated community of Somerset also is governed by this resolution. Much of the surrounding area is under the jurisdiction of the U.S. Forest Service and Bureau of Land Management.

2.6.2 Education

Public education service providers in the primary study area include the Delta County Joint School District, the Gunnison Watershed School District and the Delta-Montrose Area Vocational Technical Center. Most and perhaps all children of current mine employees attend Delta County Joint School District schools.

Children in the Somerset area of Gunnison County are served by the Delta County Joint School District. Other than those in the Somerset area, students in Gunnison County most likely would not be impacted by an increase in population or enrollment due to mining operations because the next nearest Gunnison County populated community is approximately 100 miles away.

Table 6. Delta County Joint School District Facilities and Capacities

School	Current Enrollment	Facility Capacity
Cedaredge Elementary School (K-4)	417	500
Cedaredge Middle School (5-8)	233	400
Cedaredge High School	283	350-400
Garnet Mesa Elementary School (K-2)	499	500
Lincoln Elementary School (3-4)	339	450
Delta Middle School (5-6)	340	450
Delta Middle School (7-8)	335	600
Delta High School	672	750
Crawford Elementary (K-8)	150	200
Hotchkiss Elementary School (K-4)	228	300-350
Hotchkiss Middle School (5-8)	147	350
Hotchkiss High School	310	450
Paonia Elementary School (K-4)	297	350
Paonia Middle School (5-8)	175	300-350
Paonia High School	240	450
Totals All Schools	4,665	6,400-6,550

Source: E.D. Hovee & Company, based on contacts with Delta County Joint School District, June 1999.

The Delta County Joint School District serves nearly 4,700 households in Delta County and portions of Montrose, Gunnison and Mesa Counties with 14 schools and a vocational technology school. The district is the county's largest employer with 600 full-time and 50-100 part-time employees.

Enrollment has not increased in the past three years. Overall, the 14 schools in the district are operating at 71%-73% of the indicated 6,400-6,500+ facility capacity. One school (Garnet Mesa Elementary) is at full capacity, and another school (Hotchkiss Middle School) is operating at less than 50% of indicated enrollment capacity.

Based on contacts with school district personnel, facilities in the Delta County Joint School District are reported to be in generally good condition. However, according to a district representative, Delta School District middle schools need replacing and transportation needs upgrading.

The district's combined operating and capital budget totals $25 million as of 1999. Budget resources are directly tied to the number of students receiving services. Thirty percent of district revenue is generated from local taxes, while the district receives 62% ($15.3 million) from the state equalization fund. Federal programs provide 1.5% of the district's total budget. Four-fifths of district operating expenses are attributed to personnel.

Area schools also provide services of importance to coal mines operating in Delta and Gunnison Counties. The Delta-Montrose Area Vocational Technical Center, five miles south of Delta, provides training for emergency medical technicians (EMTs), paramedics, mine workers and OSHA certification. This vocational program, which includes six Region 10 Colorado counties, employs a full-time program coordinator and a half-time administrative employee. Forty contracted outreach instructors specialize in the various fields of study; 85% of the instruction is outreach, taught on the client's site. In addition to the center located in Delta, there is a mine training facility located in Paonia.

2.6.3 Ambulance Services

Delta County ambulance service is divided between the North Fork Ambulance Service (serving Paonia, Hotchkiss and Crawford) and the Delta County Ambulance Service (serving Cedaredge, Orchard City and Delta). These ambulance services provide basic life support, emergency care and transport. The Delta County Ambulance Service also provides advanced life support and cooperates with the North Fork Ambulance service as needed.

The Delta County Ambulance Service recently formed an ambulance district and plans to contract for services from Delta's County Hospital. While each community has its own paid staff, most EMTs are volunteers. The combined district encompasses 330 square miles with a population of approximately 14,600, 55% residing outside an incorporated city. Two ambulances are kept in Cedaredge at the town hall, while three are located in Delta –one at the hospital and two at the firehouse.

Since the Delta County Ambulance Service has transitioned to a combined ambulance district, it can receive tax revenue. Its annual $850,000 budget is primarily fee-based, with 70% (approximately $600,000) coming from fees and 30% from taxes. A small amount ($50,000) of revenue comes from car registrations. The service has set aside $115,000 for capital improvements. Present budget priorities include salaries, increased staff, and vehicle replacement. The service plans to build two stations with living quarters.

The North Fork Ambulance Service is a volunteer service with a part-time secretary; about 50% of its revenue is derived from grants. Operations budget for the North Fork service is $158,000 annually and the service has $142,000 set aside for capital expenditures. Budget priorities include education, retention and maintaining community involvement.

The North Fork service is membership-based with approximately 6,800 members in an area of about 1,000 square miles, including the unincorporated community of Somerset in Gunnison County. No charge is made for ambulance calls other than the membership fee. Non-members are billed on a fee-for-service basis.

Two ambulances are stationed in Paonia, one in Hotchkiss and one in Crawford. The North Fork service needs an updated mapping system and better communications for dispatching. Because of increases in retired residents and homebuilding in more remote areas, current mapping has become outdated.

To date, little direct impact to ambulance service reportedly has been experienced due to mine operations and associated unit train traffic. According to a published report, unit coal trains are typically 100 cars long, although few cases of trains causing serious delays to emergency medical services have been documented.[12] Generally, delays tend to last two to five minutes; however, not all train crossings are blocked at the same time. Emergency vehicles typically can access unblocked crossings and go around the trains.

To help minimize any serious delays due to possible train blockages, communities in the Delta County Ambulance District alternate the side of the rail line on which the ambulance is parked. However, both ambulance services recognize the potential for greater incidence of delay with mine expansion, especially as rail traffic through the communities increases.

A substantial share of ambulance calls require advanced life support (ALS) EMTs on the ambulance because of the large number of retirees residing in Delta County. Additional ALS-trained EMTs are needed throughout Delta County.[13] The Center's EMT programs have a budget of $100,000. Resources come from the Delta County Joint School District, the state, student tuition, Pell grants and lab fees. More funding is needed for more advanced cardiac monitors, computer training programs and an ambulance for training.

Area ambulance services do not derive direct revenue from the three operating North Fork mines. The mines are not members of the North Fork Ambulance Service, so a fee for service is charged if the North Fork ambulance responds to calls at the mines. North Fork Ambulance Service would like to see the mines buy memberships for its miners.

The Delta County Ambulance Service also has no arrangement with the mines for service, but is interested in arranging coordinated coverage or a contract with the mines for service. Mines usually have on-site first aid staff or EMT personnel and ambulances. Mining companies often use the Delta-Montrose Area Vocational Technical Center to train their own EMT staff, as well as to train mine workers. For example, the vocational school works closely with the Mountain Coal Company.

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12 "Coal Mining in the North Fork, " *Delta County Independent* web site.

13 Based on telephone contact with the Technical Center's program director.

2.6.4 Fire Protection

Each Delta County incorporated jurisdiction and much of the unincorporated county is part of a fire district. Five fire districts serve the primary study area and the Somerset portion of Gunnison County.

Delta Fire District 1, located in Delta, has a 22-member volunteer fire department with a service area of 110 square miles. District boundaries stretch to the Mesa County line, the Gunnison Bridge, and the Montrose County line.

The actual service area is approximately double the size of the taxing district. The department serves 12,000-13,000 people. An annexation has been proposed to include the outlying area within District 1's boundaries, although the population is currently already being served by the district.

Fire District 1's current operations budget is $117,600 annually, with a capital budget of $177,000. The fire station is 10 years old, and equipment generally is in good condition. The district has prioritized equipment upgrades as its main current and future needs.

Paonia Fire District 2 (closest to the North Fork mines) provides fire and rescue services to a population of approximately 5,000 in a 30,500-acre (48 square mile) area. Fire District 2's 24 member volunteer department houses its equipment at the Paonia fire station.

Equipment consists of two rescue and quick response trucks, three pumpers, one brush truck, two large tankers and one foam machine. Fire District 2 rates its equipment as in good shape, but older and in need of upgrades. District representatives foresee a need for a new station and new equipment. District 2's current operations budget is $36,000, with a capital budget of $40,000. Revenues are generated through fundraising ($10,000-12,000 per year) and a property tax mill levy. Recent voter approval to double the mill levy indicates the community's commitment to and awareness of the services provided as needed.

Fire District 3 covers Cedaredge, Orchard City and Austin. A new 9,000 square foot two-story firehouse and six trucks are located in Cedaredge, and a separate substation and two trucks are located in Orchard City. One truck is housed at Grand Mesa from June through October.

Fire District 3 covers an area of approximately 300 square miles. Each community within the district has its own volunteer fire department with 24 volunteers and three to four cadets in Cedaredge, while Orchard City provides another 25 volunteers and five cadets.

Total annual budget for Fire District 3 is nearly $142,000 with a capital budget of $66,350. The district reportedly needs a firehouse in Orchard City and replacements for outdated equipment. Revenue is generated from property taxes and a mill levy.

Fire District 4 in Hotchkiss operates with 26 volunteers. The fire station occupies a small building with narrow doors housing four trucks and a rescue truck. The ambulance district stored the fire trucks until recently. The fire station also has a small meeting room.

The district also operates a separate substation at Redlands Mesa which houses two trucks with eight firefighters in the neighborhood. This district's population consists largely of ranchers, fruit farmers and miners. Most incidents involve sagebrush, oak brush and grazing land fires.

Most Hotchkiss fire department equipment is reportedly in excellent condition. Equipment includes a Class A pumper, a 3,000 gallon tanker, a 1,000 gallon tanker with a pump, and a 1959 Chevy rescue truck. Redlands also has a Class A 500 gallon pumper.

The department's current operations budget is $48,000 annually with a separate $30,000 capital budget. The district's main source of revenue are property taxes, donations and insurance companies. Budget priorities are to introduce compensation for firefighters and to maintain and purchase equipment. Current priorities are to purchase pagers and additional air packs and to update some trucks.

Fire District 5, the Crawford fire department, handles mostly rural farmland with 15 volunteer firefighters. Its major station houses two class A pumpers, a quick response truck, a 2½ ton forest truck and a 3,000 gallon truck. Current operations budget is $26,000. The department plans to develop a separate substation and purchase a new truck.

In the Paonia area, train traffic generally has not created undue delays for emergency fire vehicles. Over the past seven years, one Paonia district incident has been attributed to a train blocking a crossing. (A house burned down as fire trucks waited for a train to pass.)

With reference to possible future effects of expansion involving twice as many potential train trips per day, concern is expressed that emergency vehicles could be delayed in the future. Of 36 rail crossings, seven are situated in Hotchkiss. All of these crossings can be blocked simultaneously with a delay of up to seven minutes.

2.6.5 Law Enforcement

A combination of county sheriff and city police departments provide law enforcement services in the primary and secondary study areas. A number of the smaller incorporated cities do not have their own police force, and so rely on the county for sheriff service.

The Delta County Sheriff's Department has 55 full-time, four part-time employees, and 20 search and rescue staff to serve a countywide population of 28,000. Delta County Sheriff staffing has increased over the last two years. Its jail, a stand-alone facility with a capacity of 57, is reported to be in excellent condition. The department's annual total budget is $1,165,000.

The Gunnison Sheriff's Department has 23 full-time employees and 12 reservists serving 3,200 square miles with a population of 18,000. The Gunnison Courthouse detention center's 14-bed capacity is often 50%-100% over capacity and is considered to be obsolete. The Gunnison County department's annual budget is $785,300 with a capital budget of $456,000.

For both law enforcement departments, personnel needs are the first priority for added budget resources. Secondary needs include improved maintenance, training and transportation.

The police forces of the towns of Paonia, Hotchkiss, Cedaredge and Delta work cooperatively with the Delta County Sheriff's Department, while the communities of Crawford and Orchard City rely completely on the Sheriff's Department because they do not have police departments of their own.[14] The City of Delta has 18 full-time employees as the largest city police force in the primary study area.

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[14] Delta County Sheriff's Department provides police services at no charge.

Paonia's Police Department, located in a small portion of the town hall, operates with four officers and one part-time employee. The department has five police vehicles between four and six years old, each equipped with radar and video. The department is interested in adding another full-time employee and updating equipment.

Cedaredge employs three full-time law enforcement officers serving approximately 10,000 people, a large year-round tourist population, people with second homes, long-time residents and newcomers, many of them retired. The Cedaredge Police Department has four well-equipped patrol cars in excellent condition with a computer system tied to other departments.

The Cedaredge department's $200,000 annual budget is derived from sales and property taxes. The department has two budget priorities: to increase revenues in order to improve its pay scale and to hire an experienced sergeant. A need to replace patrol cars with four-wheel drive vehicles is also reported.

The Hotchkiss Police Department employs three full-time officers to serve 850 residents within the one square mile city limits. Hotchkiss police assist county and state patrol officers as needed.

All the city police departments contacted for this assessment express concern over the effects of coal trains moving slowly through their respective communities. For example, trains can split Hotchkiss down the middle, blocking most of the town. If train traffic doubled to ten trips per day, the community would be more impacted because intersections are typically blocked for five to seven minutes each time

2.6.6 Water Supply, Wastewater Treatment and Solid Waste

Municipal water service is provided for each of the incorporated cities in the primary study area of Delta County. Municipal sewage and wastewater treatment is provided in all of the incorporated communities except Orchard City.

In rural areas, with the exception of portions of the Paonia and Cedaredge rural areas, residents rely on private domestic or community water systems. Permits for Delta County wells on 35 acres or more are granted outright. Wells on parcels smaller than 35 acres need a well permit, granted by the state of Colorado. In unincorporated Delta County, individual septic permits are issued by the county and the local health department. Septic systems need proper leach fields.

Delta County has an EPA-approved landfill in the Tongue Creek area, with a transfer station in the North Fork area. The county also has a voluntary recycling program and has established a task force to deal with issues concerning septic, compost, and agricultural water uses.

Solid waste service is available through private contractors in all communities. Some communities require residents to sign up for garbage service while other communities do not.

The City of Paonia provides water, sewer, and solid waste pick-up to city residents as well as water and sewer service to an estimated 1,000 customers situated outside the city limits. Three persons are employed by Paonia's Public Works Department. The city's water fund is $305,700 and the sanitation fund is $523,550, with revenue generated from metered water fees, new water taps and sales tax. Funding also is received from a severance tax for miners who live in the area and from energy impact funding.

Paonia's public works priority is to build a new sewage treatment plant to come into compliance with Environmental Protection Agency (EPA) regulations. The city's sewage treatment plant, built

in 1965, is at or over capacity, and experiences extremely high ammonia discharge levels. A new water/sewage treatment plant is being planned for 57 acres below town with a lagoon and land application to correct the ammonia discharge problem. Estimated cost is $4 million.

The city is also studying additional water storage capacity. Current storage consists of a two million gallon tank, a one million gallon reservoir, and a second reservoir with a 500,000 gallon capacity, for total storage capacity of 3.5 million gallons.

Crawford provides water and sewer for approximately 200 households. Water usage is now at 90% capacity. Crawford's lagoon is at 25% of capacity according to EPA standards, and the town is planning more water lines. The town is planning an expansion of the sewer ponds. In Crawford, residents arrange for their own garbage service, available through several companies.

Hotchkiss provides water and sewer with an annual public works budget of $191,500 and a capital budget of $174,700. The town contracts with BFI as a private operator for garbage pick-up, which town residents are required to have. Those who have town water/sewer service but who live outside the town limits, may sign up for garbage service, but are not required to do so.

The City of Delta provides sewer and water service to city residents as well as to areas beyond the city limits which are part of a city annexation program. All Delta residents have city sewer service, with the exception of a few isolated areas which have individual septic systems. Delta's sewage treatment plant is approximately 15 years old and operates well below available capacity.

City of Delta residents are required to subscribe to City of Delta garbage pick-up. Residents of newly-annexed areas may use the City's service or contract with a private hauler.

Delta buys water from the Project 7 water supply in Montrose. Project 7 provides domestic water, regional treatment and transportation (pipes) to communities purchasing water from this company.

Project 7 treatment plant capacity is questionable. The plant was not built to meet new regulations and Project 7 plans to expand the water treatment plant and to add storage. The company is asking customers to create their own localized water reserves.

Orchard City encompasses 11 square miles with a population of 2,300. The city provides domestic treated water but no sewer or septic service. Orchard City's water budget is $1,035,500. Spring and reservoir water is provided to residents and reportedly is plentiful. Each city household is allowed 30,000 gallons per month with households outside the city limits allowed 7,000 gallons per month. A new building for water filtration is under construction at an estimated cost of more than $750,000.

Cedaredge serves a population of 2,000 in town and a portion of the outlying rural area. The three cells of its 25-year old treatment plant have been modernized. Formerly subject to a cease and desist order, Cedaredge's updated water treatment plant is one of three national finalists for a national EPA award for Most Improved Small System Wastewater Treatment. The plant is near capacity, so the city is considering further enlargement/ updating or the construction of a new plant at a different location. Cedaredge utility revenue comes from sales tax together with water and sewer utility bills.

2.6.7 Hospital and Medical Services

Delta Hospital, in Delta, operates as a full-service, general acute care hospital with 49 beds, home health care, a staff of 28 doctors, and 198 full-time and 89 part-time employees. The hospital's primary service area comprises Delta County together with the communities of Olatha in Montrose County and Somerset in Gunnison County.

Delta Hospital's $14 million annual operations and $2.5-$3.0 million capital budgets come from patient billings and a mill levy through a local taxing district. Older citizens tend to use hospitals more intensively so the rising number of retirees living in the area affects Delta Hospital. Most patient care is funded by Medicare/Medicaid, requiring deep hospital discounts. An estimated 80% of Delta Hospital's patients are on Medicare, with private pay patients including insured patients making up the Medicare gap.

Few patients have company health insurance. Just 8% of Delta Hospital patients have business-provided insurance. Remaining patient costs are paid by the patient or by Medicare/Medicaid.

Train traffic represents a concern although EMT service has not been seriously affected because flexible dispatching has been able to work successfully around blockages.[15]

2.6.8 Electrical Utilities

Denver's Tri-State Generation and Transmission Association, Inc. generates and sells power to 32 member cooperatives throughout Colorado, Wyoming and Nebraska. These include Delta-Montrose Electric Association (DMEA) and Gunnison Electric serving the primary and secondary study areas.

The DMEA serves approximately 25,700 customer accounts in Delta and portions of Montrose and Gunnison counties. As a cooperative, DMEA operates as a non-profit and returns excess revenue to its consumer-owners.

DMEA's service area includes east Montrose County, western Gunnison County, and all of Delta County. The utility is a non-profit membership cooperative whose members are the residential, commercial, and industrial users within the area's population base of nearly 28,000. Residential customers account for 44% of users, while 28% are small commercial users and 27% are large commercial or industrial customers. The association is expanding by about 1,000 meters annually.

DMEA employs 34 persons and contracts with another 108 businesses. Its $25 million operations budget covers purchase and distribution of electric power. Operations expansion is at cost to the customers and the utility's capital budget totals $6 million.

North Fork area mines are members of DMEA. Electrical improvements made at mining sites are paid for up-front by the mines before capital improvements are made.

To accommodate operating mines, the co-op has made several changes over the years, such as upgrading the Waunita sub-station, located near. Delivery points and land taps were added.

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[15] Based on interview with hospital administrator.

2.6.9 Social Services

Delta County Social Services provides public assistance to low-income families and the elderly. A total of twelve programs including food stamps, low energy assistance, pension assistance, child support enforcement, and child welfare are administered by the agency's staff of 45 full-time employees. Overall, case loads are decreasing except for assistance to the elderly which is increasing, albeit intermittently.

The agency serves Delta County residents and also contracts with Gunnison County to provide services. Its main facility is in Delta and it also rents additional space from churches and other facilities. The agency's own building is considered too small but is in good condition.

2.6.10 Roads

In 1996, average daily traffic (ADT) on Highway 133 east of Paonia was 3,150 vehicle trips per day. Traffic counts in the Somerset area average 2,000 per day and decrease to only 1,050 per day between the Somerset area and town of Marble.

In the Paonia, Hotchkiss, and Crawford area, most of the truck traffic is not mine-related. Coal is primarily moved by train. Mine-related truck traffic consists of getting equipment to and from the mines. The exception is truck traffic from the Bowie mine to a train loadout located five miles away. Highways 133 and 65 are considered scenic routes and are heavily traveled by tourists.

According to a variety of local sources contacted for this socioeconomic assessment, trains are a problem, sometimes simultaneously blocking several crossings in town. Blocking the Delta intersection of Highways 50 and 92 causes traffic jams.

2.7 Fiscal Conditions

Coal mine operations generate a significant amount of federal, state and local government revenues. The federal government receives revenue from land and mineral rights leases, as well as royalties. The State of Colorado receives tax revenues primarily from federal royalties, sales, severance, and income taxes. Local governmental entities receive property, sales, and severance taxes, as well as a share of the federal royalties.

Additional governmental revenues are generated from businesses that supply the mines with goods and services, as well as from the employees of the mines. Local purchases made by the mines generate sales taxes. Also, the income generated by local businesses is subject to state and federal income taxes.

Mine workers also are a source of government revenues. Incomes earned by the mine workers are subject to state and federal income taxes. Household purchases generate sales taxes; and property owned by the mine workers is subject to property taxes.

2.7.1 State of Colorado Revenues

Net state and local revenue collections totaled $6.3 billion in 1998. Revenue collections have been increasing steadily over the last ten years. Since 1989, revenue collections have increased, on average, at a rate of $400 million annually. See Figure L-19, Net State and Local Revenue Collections.

Approximately 87% (or $5.5 billion) of net state and local revenue collections are from taxes levied at the state rather than local level. Fifty-seven percent of state tax collections come from income taxes, about 91% from individuals and only 9% from corporate taxpayers. State sales tax (excluding the local levied portion) accounts for another 26%. Severance tax, which gets redistributed back to local jurisdictions, accounted for only 1% of all Colorado tax collections statewide. See Figure L-20, Major Source of Colorado State Tax Collections (1998).

Between 1989 and 1998, income taxes collected from individuals (including fiduciary agencies) more than doubled. In 1998, the state collected $2.9 billion in net income taxes from individuals, an increase of $1.6 billion (or 118%) over 1989 collections.

Income tax collections from corporate firms have increased at a much slower rate. Between 1989 and 1998, corporate income taxes increased by $108 million, or 65%. See Figure L-21, State Income Tax Collections (1989 to 1998).

This overview of state revenue sources provides a context for the discussion of local tax revenues in Delta and Gunnison Counties.

2.7.2 County Revenues and Expenses

Taxes account for 69% of total county revenues in Delta County and 64% of revenues in Gunnison County. Tax revenues also are increasing more rapidly than all revenues combined.

On the expenditure side, general governmental expenditures account for 55% of county expenditures in Delta County and 59% in Gunnison County. Growth of general governmental expenditure also is outpacing total expenditures in both counties. Public safety represents the number two expenditure item in both Delta and Gunnison Counties.

2.7.3 Retail Sales Tax

Both incorporated cities and counties in Colorado receive sales tax (at locally determined rates) based on the sales of tangible personal property and services, such as furniture, electronics, telephone service, dining, lodging, and other similar items.[16] Retail sales in Delta County have been relatively flat over the last six years. In 1998, approximately $289.2 million in retail sales were generated in Delta County, an increase in retail sales of 29% over 1993 sales levels. Retail sales in Gunnison County (as well as statewide) increased by 41% over this same time period.

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[16] Items exempt from sales tax include gasoline, cigarettes, food for home consumption, prescription drugs and prosthetics, certain machinery and machine tools, etc.

Table 7. 1997 County Government Revenues and Expenditures

	Delta County	Gunnison County	Comments
Revenues:			
Taxes	$2,862,648	$2,666,437	Delta County taxes increased by 11% since 1995; Gunnison County increased by 42% since 1992.
Licenses & permits	$4,825	$144,069	License & permit fees in Delta County increased by 47% since 1995; Gunnison County increased 42% since 1992.
Intergovernmental	$192,352	$272,772	Intergovernmental revenues increased by 60% in Delta County since 1995; Gunnison County increased by 3% since 1992.
Charges for services	$108,736	$723,976	Delta County charges for services decreased by 30% since 1995; Gunnison County increased by almost 35% since 1992.
Fee accounts	$653,184	-	Fee accounts in Delta County increased by almost 16% since 1995. Gunnison County collected almost $180,000 in 1992 and none in 1997.
Miscellaneous	$354,298	$363,986	Miscellaneous revenues decreased by almost 6% in Delta County since 1995; Gunnison County increased by 67%.
Total Revenues	$4,176,043	$4,171,240	Total Delta County revenues increased by 10% since 1995. Gunnison County revenues increased by 31% since 1992.
Expenditures:			
General government	$2,244,751	$2,587,891	General government expenditures increased by 11% in Delta County since 1995. Gunnison County increased by almost 50% since 1992.
Public safety	$1,564,155	$1,184,952	Public safety expenditures increased by 18% since 1995 in Delta County. Gunnison County increased by almost 24% since 1992.
Public works	$162,853	-	Public works expenditures decreased by almost 25% since 1995 in Delta County.
Health & welfare	$1,500	$449,468	Health & welfare expenditures stayed the same in Delta County from 1995-1997; Gunnison County increased by almost 59%.
Culture & recreation	$121,350	$186,069	Delta County culture & recreation expenditures increased by almost 143% since 1995. Gunnison County increased by almost 69%.
Economic development			
Conservation natural resource	$4,120	-	Conservation natural resource expenditures increased by 6% since 1995 in Delta County.
Intergovernmental			
Capital projects			
Debt service			
Total Expenditures	$4,098,729	$4,408,380	Total Delta County expenditures increased by 13% since 1995. Gunnison County increased by 43% since 1992.
Excess Revenues Over/ (Under) Expenditures	$77,314	($237,140)	
Other Financing Sources (Uses)			
Sale of assets			
Loan proceeds			
Operating transfers (In)	$199,892	$347,542	Operating transfers in increased by 23% in Delta County since 1995.
Operating transfers (out)	($150,740)	($10,070)	Operating transfers out increased by almost 5% in Delta County since 1995; Gunnison County decreased by 74% since 1992.

	Delta County	Gunnison County	Comments
Revenues:			
Total Other Financing Sources (uses)	$49,152	$337,472	
Excess Revenues & Other Sources Over/(Under) Expenditures & Other Uses	$126,466	$100,332	
Fund Balance –January 1	$1,428,264	$1,335,651	
Fund Balance –December 31	$1,554,730	$1,435,982	

Source: *Gunnison County, Colorado 1994 Adopted Budget Summary*, December 7, 1993; *Gunnison County, Colorado 1999 Annual Budget*, December 15, 1998; *Delta County, Colorado Combined Statement of Revenues, Expenditures and Changes in Fund Balance, All Governmental Fund Types*, December 31, 1997 and December 31, 1995, compiled by E.D. Hovee & Company, July 1999.

Table 8. Retail Sales by Jurisdiction (1998)

Jurisdiction	Retail Sales (000s)	Population	Sales/Capita	Tax Rate	Total Tax Generated
Delta County:					
Cedaredge	$18,479	1,920	$9,624	1.5%	281,000
Crawford	$1,780	280	$6,357	2.0%	34,000
Delta	$161,247	5,600	$28,794	3.0%	2,369,000
Hotchkiss	$20,718	915	$22,643	2.0%	276,000
Paonia	$19,175	1,765	$10,864	2.0%	306,000
Remainder (unincorporated)	$67,846	16,139	$4,204	2.0%	996,000
Total	$289,245	26,619	$10,866	-	4,262,000
Gunnison County:					
Crested Butte	$51,406	1,130	$45,492	4.0%	1,125,000
Gunnison	$164,655	5,195	$31,695	3.0%	2,727,000
Mount Crested Butte	$33,638	365	$92,159	4.0%	851,000
Remainder (unincorporated)	$109,068	5,766	$18,916	1.0%	525,000
Total	$358,767	12,456	$28,803	-	5,228,000
State of Colorado	$82,595,077	3,970,971	$20,800	3.0%	1,347,397,000

Source: Colorado Department of Revenue.

While Gunnison County has fewer permanent year-round residents than Delta County, the level of retail sales is higher in Gunnison County than Delta County, at $358.8 million versus $289.2 million respectively. Higher retail sales levels in Gunnison County are primarily due to a substantially larger tourism industry than Delta County. See Figure L-22, Retail Sales Trends (1993-1998).

Businesses within the City of Delta captured over $161 million worth of retail sales in 1998, representing 56% of all retail sales in Delta County. In contrast, the City of Paonia experienced $19.2 million in retail sales and the City of Hotchkiss captured another $20.7 million. These two jurisdictions together account for less than 14% of all retail sales in Delta County.

As noted, Gunnison County generates a higher level of retail sales than does Delta County. Almost 46% of Gunnison County retail sales are generated within the City of Gunnison. Together, Delta County and Gunnison County accounted for over $648 million in retail sales in 1998. This sales volume represents less than 1% of all retail sales statewide.

Delta County generates a relatively low level of retail sales activity as compared to its population. In 1998, Delta County generated $10,900 per person in retail sales, approximately one-half the

statewide rate and less than one-third of Gunnison County's rate. Highest per capita sales rates were experienced in the City of Delta ($28,800) and Hotchkiss ($22,600).

In Gunnison County, retail sales data is reported for three jurisdictions. Mount Crested Butte captured the highest per capita amount at nearly $92,200. Although Mount Crested Butte generated just 9% of Gunnison County retail sales, its status as a resort community and tourism draw likely account for its high level of per capita sales. Crested Butte, a nearby resort community, also experiences relatively high per capita retail sales at $45,500.

Crested Butte and Mount Crested Butte have implemented the highest local retail sales tax rate in the secondary study area at 4%. The 3% tax rate in the major retail centers of the cities of Delta and Gunnison equals the statewide rate.

2.7.4 Property Tax

In 1998, over $8.6 million in property taxes were collected in Delta County. Almost 48% came from residential properties, the largest source of property tax revenues. Approximately 18% of property taxes came from agriculturally-owned property while commercial properties represented just under 16%.

About half of the property taxes collected in Delta County went to the Delta County Joint School District. The mill levy rate of $32.52 per $1,000 assessed value generates over $4.2 million in property tax revenues, 49.5% of total Delta County property taxes. The county portion represents 28% of all property taxes assessed countywide, while towns and cities collect a mere 2% of all property taxes levied countywide. See Figure L-23, 1998 Delta County Property Taxes.

In 1998, coal mines represented $5.7 million of Delta County assessed valuation and $31.5 million in Gunnison County for a combined valuation of $37.2 million. The majority of the assessed value is located in Gunnison County's Somerset community. The greatest share of mine-generated property tax revenues went to the Delta County Joint School District which received more than $1.2 million in 1998.[17]

Railroads serving the coal mines within the secondary study area also constitute a significant property tax revenue source. In 1998, their assessed Delta County value totaled $4.1 million.

2.7.5 Severance Tax

In 1998, Colorado coal mines generated over $9.3 million in severance tax revenues, over $3.3 million more than in 1989 but $1.5 million less than the amount generated in 1997. Since 1989, the long term trend in severance taxes paid in Colorado generally has been up, but with significant year-to-year variations. See Figure L-25, State Coal Severance Tax Trends (1989-1998).

While much of the mining within the secondary study area occurs in the Somerset area of Gunnison County, most mine employees live in Delta County. Because much of the mine activity is located outside the communities where mine employees live, Colorado has implemented a severance tax to help communities pay for services provided to mine employees.

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[17] Source of information comes from Delta County Assessor, Gunnison County Assessor's Office, and The Delta County Independent Newspaper, *Coal Mining in the North Fork.An Introduction*, March 4, 1999.

Based on state severance tax records, 278 employees live in Delta County; 95% of all employees who live in the secondary study area. Nearly 47% of employees live in Paonia, which received almost $51,800 in severance taxes in 1998.

Table 9. Severance Tax Distribution by Principality

	1995		1996		1997		1998	
Community	Emp.	Tax	Emp.	Tax	Emp.	Tax	Emp.	Tax
Delta County	286	$68,055	244	$67,795	273	$118,593	278	$104,293
Cedaredge	1	$237	3	$885	7	$3,004	6	$2,254
Crawford	54	$12,849	28	$7,779	19	$8,156	41	$15,381
Delta	27	$6,424	24	$6,668	23	$9,873	33	$12,380
Hotchkiss	28	$6,662	23	$6,390	32	$13,736	29	$10,879
Orchard City	3	$1,400	1	$277	3	$1,287	9	$3,376
Paonia	144	$34,265	126	$35,009	112	$48,079	138	$51,771
Rest of Delta County	29	$6218	39	$10787	77	$34458	22	$8,252
Gunnison County	20	$4,759	13	$3,612	14	$6,009	16	$6,002
Delta + Gunnison	306	$72,814	257	$71,407	287	$124,602	294	$110,295

Source: The Delta County Independent Newspaper, *Coal Mining in The North Fork.An Introduction*, March 4, 1999.

2.7.6 Federal Royalties

In 1998, coal mines in Delta County also generated $742,400 in federal royalties. Half of this amount was returned to Delta County. The mines in Gunnison County generated over $6.6 million in royalties; Gunnison County received half or $3.3 million.

Colorado also receives Federal Mineral Lease Fees. These are put into a fund called the energy impact grant program and are available to Colorado communities to fund projects ranging from bridges to recreation. Communities apply for these funds and successful projects are selected by the state. Available funds totaled $12 million in 1998.

Eligibility for the energy impact grant program is based on a competitive application process. Program funds may be used for planning, construction, and maintenance of public facilities or for public services. Priority for project funding is given to communities affected by energy related activities.

2.8 Recreation

Delta County is surrounded by the Grand Mesa, Uncompahgre Plateau and the West Elk Mountains. Portions of Gunnison National Forest and Grand Mesa National Forest are located within Delta County. These significant natural amenities, along with wilderness areas and state parks, offer numerous outdoor activities such as hiking, mountain biking, camping, fishing, hunting and other activities.

Delta County also offers several points of interest and festivities. Significant points of interest include Fort Uncompahgre, Delta City's "City of Murals," Pioneer Town in Cedaredge, and West Elk Loop Scenic Byway. The Ute Indians' Council Tree Pow Wow is one of the most renowned festivals in Delta County.

Within the immediate vicinity of the North Fork coal mines, hunting and other dispersed recreation occurs on a relatively limited basis due to lack of developed recreation facilities. There are no developed recreational facilities operated by the BLM or Forest Service on the proposed coal lease tracts and exploration license area associated with this EIS. (See Section 3.13.2.9, Recreation,

for additional discussion on recreation activity occurring within or adjacent to the proposed coal lease tracts and exploration license area.)

Tourism plays a larger role in the Gunnison County economy than in Delta because of mountain oriented resort activity. Gunnison County has several resort communities, Crested Butte being one of them. Gunnison County also has a number of significant natural features such as the West Elk Mountains, Rocky Mountains, Black Canyon, and Curecanti National Recreation Area. Points of interest include the Mountain Bike Hall of Fame, Crystal Mill, Blue Mesa Lake (the state's largest), Rocky Mountain Biological Lab, and Tincup, an historic mining ghost town.

Tourism and travel expenditure data is available for Colorado by county. Tourism and travel spending is defined as purchases by travelers during their trip, including lodging taxes and other applicable local and state taxes paid by the traveler at the point of sale.

In 1997, tourists spent nearly $21.4 million in Delta County. Over 43% (or $9.3 million) comes from visitors staying with friends and family in private homes. Another 33% is from visitors who stayed in lodging facilities.

Over $130 million was spent by tourists in the entire secondary study area, 84% captured by Gunnison County. Visitors staying in lodging facilities represent 63% of all travel spending. Tourists staying in vacation homes spent almost $16.0 million (or 12%) in 1997.

Table 10. 1997 Travel Spending by Type of Accommodation ($1,000)

Accommodation Type	Delta	Delta + Gunnison	Colorado
Destination Spending	$21,380	$126,720	$6,873,120
Lodging	$7,020	$81,600	$4,845,360
Private Campgrounds	$2,120	$8,080	$128,310
Public Campgrounds	$380	$7,110	$137,890
Private Home	$9,300	$13,970	$1,201,280
Vacation Home	$2,560	$15,960	$319,250
Pass Through	-	-	$241,030
Air Transportation in County	-	$3,350	$253,970
Total Spending	$21,380	$130,070	$7,127,090

Source: Colorado Tourism Board and the Colorado Travel and Tourism Authority.

In Delta County, the largest share (29%) of travel expenditures is spent at dining establishments. Another 23% is spent on retail items. Less than 15% of expenditures is spent for overnight accommodations.

In the larger secondary study area, travel expenditures are fairly evenly distributed between business types –with the exception of air transportation. Spending for overnight accommodations accounts for the largest share (25%) of total spending. Spending for ground transportation accounted for 14% of total expenditures.

Table 11. 1997 Travel Spending by Type of Business ($1,000)

Business Type	Delta	Delta + Gunnison	Colorado
Destination Spending	$21,390	$126,740	$6,873,110
Accommodations	$3,140	$32,460	$1,879,090
Dining	$6,270	$29,730	$1,802,740
Retail Sales	$4,900	$25,080	$1,248,340
Recreation	$3,210	$21,800	$923,950
Ground Transportation	$3,870	$17,670	$1,018,990
Air Transportation in County	-	$3,350	$253,970
Total Spending	$21,390	$130,090	$7,127,080

Source: Colorado Tourism Board and the Colorado Travel and Tourism Authority.

Travel spending in Delta County generates about 380 jobs, half of which occurs with dining establishments. Average wage in the tourism sector is $10,200; $5,500 less than the average wage for all Delta County workers.

Approximately 1,920 jobs are supported by travel spending in the entire secondary study area. A significant share of the tourism job base (41%) is associated with dining establishments. Overnight stay facilities (23%) and recreation facilities (21%) employ another 44% of tourist sector workers. Average wage in the tourism sector is $14,800, higher than Delta County but $2,300 less than the average wage for all workers in the entire secondary study area.

Table 12. Employment Generated by Travel Spending (1997)

Business Type	Delta	Delta + Gunnison	Colorado
Accommodations	70	450	32,090
Dining	190	780	47,400
Retail Sales	30	160	8,080
Recreation	70	410	17,910
Ground Transportation	20	90	4,760
Air Transportation in County	-	30	2,080
Total Employment	380	1,920	112,320
Average Wage	$10,200	$14,800	$13,700

Source: Colorado Tourism Board and the Colorado Travel and Tourism Authority.

In 1997, travel spending generated almost $1.2 million in tax revenues in Delta County. Throughout the entire secondary study area, nearly $6.8 million of tax revenues are generated. The majority of tourism related taxes generated statewide are collected by Colorado's local communities.

Table 13. 1997 Tax Revenues Generated by Travel Spending ($1,000)

Taxes Generated	Delta	Delta + Gunnison	Colorado
Local Taxes	$740	$4,040	$221,300
State Taxes	$420	$2,710	$166,880
Total Tax Receipts	$1,160	$6,750	$388,180

Source: Colorado Tourism Board and the Colorado Travel and Tourism Authority.

2.9 Social Values

The social values of a community reflects the complex interaction of local customs, lifestyles and norms. More than one set of values may be present in a community at a time, as different groupings of people may share certain values in common, but different from others in the

community. And values can change over time, whether as the result of changing preferences by existing residents or with the combined forces of in-migration and out-migration.

People often prefer to gravitate to friends, social organizations and communities that share similar cultural backgrounds, needs, behavior patterns, and social perspectives. Households tend to live in areas that offer lifestyles and social values similar to their own. This is particularly true in non-metropolitan or rural communities which traditionally have been less diverse than their urban counterparts. However, even relatively homogenous rural communities are becoming more diverse with in-migrants who may bring different social values and expectations for their adopted community.

An area's social makeup often remains reasonably stable over time. Changes may occur incrementally over a long period of time. A community's stability is derived from its fixed features; housing mix, transportation, schools, job base, and spiritual organization.

Changes usually occur due to transitions in a household's lifestage such as leaving home, "emptying the nest," job relocation, or retirement. In some communities, changes become great or abrupt enough that economic or social conditions become incompatible with a particular household's lifestyle or economic needs. This may prompt a household to relocate to another area with residents who share similar lifestyles, social values or better economic opportunity.

An evaluation of social values may utilize both quantitative as well as qualitative sources of information.

The social values information considered in this assessment is based on data compiled by Claritas, Inc. Specializing in natural demographics, this research firm classifies households into 15 social groups using U.S. Census data and consumer data. Information used includes household composition, mobility, ethnicity, social rank, urbanization, and housing data.

Although fifteen major social groups have been identified nationwide, just three are identified by Claritas' analysis as having a significant presence in Delta County.[18] Each of these groups represents a distinctive type of lifestyle, consumer and social behavior.

According to Claritas, rustic living households comprise the greatest proportion (approximately 60%) of Delta County households. These residents tend to have attained a high school education, have low to lower-middle incomes, live in relatively isolated low cost rural areas, and are often older singles or larger yet relatively lower-income families. They often make their living from the land, perhaps from agriculture, mining or construction. The Delta County proportion of rustic living households is six times greater than their proportion in the U.S. as a whole.

Heartlanders make up a second important component (almost 35%) of Delta County's population mix. Delta County heartlanders tend to be older residents with lower middle incomes. They may be couples or part of large, multi-generational families who live in relatively lower-cost areas. Heartlanders are characterized by Claritas as white or Hispanic, with some college education, who fiercely value their independence. Heartlanders are represented nine times more often in Delta County than in the U.S. as a whole.

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[18] Claritas, Inc., June, 1999.

Besides a high concentration of rustic living and heartlander households, the secondary study area also is well-represented by a third social group, country families. This segment comprises approximately 5% of Delta County households. Their midscale affluence is derived in large measure from the relatively low cost of living available in Delta and Gunnison Counties. Demographically, this lifestyle segment is primarily comprised of homeowning married couples with children who tend to work in industrial or agrarian occupations and whose roots are in farming. Country families are found slightly more often in Delta County than in the U.S. as a whole.

The larger seven-county Central Western Slope region tends to have a greater diversity of social. The region is distributed between *second city center, second city blues* and *working town* households as well as rustic living, heartlander, and country family households. Rustic living families comprise approximately 17% of Central Western Slope households, with heartlanders and country families comprising 14% and 12% respectively.

Second city center households comprise just over 15% of households in the Central Western Slope. They are a highly diverse set of middle class individuals and families. They range from older white-collar married couples with grown children, to aging blue-collar empty nesters, to young blue-collar starter families.

The region's "second city blues" (almost 15% of Central Western Slope households) tend to have lower middle incomes and are a mix of working age and retired households. Working age individuals tend to have relatively low or entry-level white-collar occupations such as sales and technical positions. Some are young singles just starting a career, while others are ethnic (often Hispanic) families working in service and labor occupations.

Central Western Slope working town households (11%) are predominantly white, blue-collar families. Many are retired seniors and tend to be lower middle income couples or poor singles. A few are lower middle income, blue-collar, ethnic (often Hispanic) families.

Following just behind the second city blues is the grouping labeled by Claritas as "landed gentry." With 9% of the Central Western Slope's population, this grouping is characterized by predominately affluent, well educated, older white executives with families.

Some social groups that are well represented in Colorado have virtually no presence on the Central Western Slope including Delta and Gunnison Counties. Examples are "elite suburbs," "urban uptown," "the affluentials," "inner suburbs," "urban midscale," and "urban cores."

In all three study areas evaluated (Delta County, Delta and Gunnison Counties, and the Central Western Slope), the most-represented social groups tend to be mid to lower income blue collar retirees or large families. *Rustic living, heartlander,* and *country families* all enjoy a relatively low cost of living, with high proportions of residents involved in occupations linked directly or indirectly to Colorado's natural resources.

The larger Central Western Slope region attracts a more affluent population due to its quality of life attributes. These households, although growing, do not yet represent the majority share of the population.

Table 14. Lifestyles of Study Area Households (1998)

	Urban Class*	Social Group**	Delta County	Delta + Gunnison	Central Western Slope	State of Colorado
High	S1	Elite Suburbs	0.0%	0.0%	0.0%	3.9%
↑	U1	Urban Uptown	0.0%	0.0%	0.0%	10.0%
	C1	2nd City Society	0.0%	0.0%	1.9%	3.1%
	T1	Landed Gentry	0.0%	0.0%	9.0%	6.7%
	S2	The Affluentials	0.0%	0.0%	0.0%	5.8%
	S3	Inner Suburbs	0.0%	0.0%	0.0%	10.4%
	U2	Urban Midscale	0.0%	0.0%	0.0%	11.5%
Degree of Affluence	C2	2nd City Center	0.0%	7.2%	15.3%	5.1%
	T2	Exurban Blues	0.0%	0.0%	5.2%	6.3%
	R1	Country Families	5.1%	15.0%	11.6%	7.1%
	U3	Urban Cores	0.0%	0.0%	0.0%	9.8%
	C3	2nd City Blues	0.0%	0.0%	14.9%	7.7%
	T3	Working Towns	0.0%	0.0%	11.2%	3.3%
↓	R2	Heartlanders	34.5%	26.8%	14.2%	4.0%
Low	R3	Rustic Living	60.4%	50.9%	16.7%	5.3%
		All Social Groups	100.0%	100.0%	100.0%	100.0%

Note: * U=Urban, C=Second City, S=Suburban, T=Town, and R=Rural.

** Social Group names are registered trademarks of Claritas, Inc.

Source: Claritas, Inc.

Several overall observations regarding social values of the Delta County rural communities most directly connected to current and potential future mining activities include:

- North Fork communities along the Gunnison River have a long history with coal mining extending back to the late 1800s; however, like much of the American West, the primary study area of Delta County is in transition both economically and culturally. Local communities are becoming more diversified with less dependence on coal mining as a source of income but continued economic benefits from the relatively high-wage jobs.

- Delta County has not yet experienced the rapid in-migration of new social groupings occurring elsewhere in counties of Colorado's Central Western Slope region; however, there is evidence of growing difference in social values of newcomers versus long-time residents. It is generally believed that newer residents are less supportive of traditional rural area natural resource activities including ranching, farming and mining.

- In Delta County, over 60% of households are identified with demographic and lifestyle characteristics of "rustic living." These households tend to come from a tradition and/or remain actively involved in making a living from the land — including agriculture, mining and construction. Households who fit in this "rustic living" category comprise only 17% of Central Western Slope and 5% of all Colorado households, and are therefore much less likely to represent in-migrants to Delta County.

- A number of primary study area residents tend to value the economic opportunity represented by North Fork mining activity. Expanded coal mining also raises concerns of potential negative lifestyle effects such as train noise/crossing blockage, to effects of future temporary or permanent closures on mine workers, their families and affected communities.

- Whether or not coal mining is viewed as having a positive or negative effect on quality of life depends on the values that receive greatest emphasis from different residents of the North Fork region. Those who place greater emphasis on the economic stimulus and continued job opportunity presented by ongoing coal operations tend to be supportive of continued or expanded coal operations. Those who chose to reside in the area to leave behind the hustle, bustle, noise and pollution of urban living and modern industrial society raise questions or are less favorable to ongoing or expanded North Fork coal mine operations.[19]

2.10 Land Ownership and Values

An estimated 56% of Delta County land is in public ownership with another 37% in agricultural use. Only 7% of all land is in non-agricultural private ownership.

As of 1998, total assessed value in Delta County is $167.1 million. Residential properties (at 36%) represent the largest proportion of assessed value. Agricultural land accounts for 14%, with about half the assessed value represented by residential structures. Commercial properties represent only 12% of total assessed Delta County value and industrial uses accounts for less than 1%.

Ten percent of the assessed value in Delta County is comprised of public utility properties (state assessed). Together, public utilities in Delta County account for over $16 million in assessed value. Electric companies make up $5.0 million, telecommunications firms represent another $4.7 million and railroad companies account for $3.9 million. The remaining nearly $2.0 million is owned by gas pipeline companies, private car companies and airline companies.

Over $36.8 million of property representing 22% of all assessed value in Delta County is exempt from property taxes. Exempt properties are primarily in public ownership, such as forest lands, wildlife areas and property owned by governmental jurisdictions. See Figure L-25, Delta County Assessed Values (1998).

Only 4% of Delta County's tax assessed valuation consists of natural resource-related properties. These include mine properties.

3.0 SOCIOECONOMIC EFFECTS

This section discusses the socioeconomic effects of a No-Action Alternative and three Action Alternatives.[20] The assessment of socioeconomic effects used a variety of information. This

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[19] Section 9.0 of the *North Fork Coal EIS –Scoping Document* contains a more complete discussion of quality of life issues as part of the "Synopsis of Public Scoping Comments."

[20] See Chapter 2 of the EIS for a description of the alternatives. Not explicitly assessed with this analysis (But not excluded) are the possibilities of other leasing options including issuance of only one lease and production limits. These possibilities are described respectively by Section 3.14.4.1, Issuance of Only One Lease and Section 3.14.4.2, Production Limits, of the transportation analysis to this EIS.

includes information from the IMPLAN model,[21] interviews with local government officials and mine representatives, data from the U.S. Bureau of Economic Analysis, and information from the Colorado State Department of Local Affairs.[22]

The assessment of socioeconomic effects considers the impact of each alternative on the study area in terms of changes in employment, income, housing, population, school enrollment, other community and public services, recreation, social values, land ownership/values and fiscal conditions. For Alternatives B, C and D, four types of impacts are evaluated:

- **Direct Effects:** The effects caused by either leasing or not leasing, and the effects of granting or denying the exploration license. These effects include the additional employees hired as a result of additional mine production, additional goods and services purchased by the mines from local businesses, additional mine worker household expenditures, and additional fiscal revenues and expenses incurred as a result of the alternatives.

- **Indirect Effects:** These effects present the additional (or ripple) effects associated with the alternatives. These represent both indirect and induced impacts. Indirect impacts are the effects to so-called backward linked industries (e.g., local firms providing goods and services to the mines. Induced impacts are the effects of household expenditures that could result from the alternatives.

- **Total Effects:** These effects are the combination of direct and indirect effects.

- **Cumulative Effects:** These effects include the broader socioeconomic effects on the larger seven-county central western slope area.[23] These effects are more removed in time and geography from direct and indirect effects, but are reasonably foreseeable.

Direct and indirect socioeconomic impacts are evaluated both Delta and Gunnison Counties. Fiscal effects are evaluated in terms of direct consequences, as indirect effects are less readily quantified. Cumulative impacts are discussed primarily in the context of the larger seven-county tertiary study area.

Due to the nature of the local coal mining industry, underlying technological changes, and relative low levels of added employment needed for longwall mining as compared to room and pillar mining for projected future tonnages, Type II Income multipliers were used in assessing the economic impacts for each alternative. The Type II income multiplier is used because none of the

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[21] IMPLAN is an economic model providing information that identifies the relationships between multiple economic sectors at the county level. The model was developed for the Forest Service by the University of Minnesota and draws on a national database from the U.S. Bureau of Economic Analysis and provides data for 528 economic sectors. The state of Colorado also has an economic impact model called RIMS; this model only provides information for 38 aggregated industries by region. The RIMS model places Delta County in one region and Gunnison in the other region.

[22] The IMPLAN model, updated annually, identifies linkages between different sectors of the economy for every county in the United States. The model has the capability to be modified on a customized basis, incorporating local data or other information useful to better tailor the analysis to the unique circumstances of a particular industry in a specified county or group of counties.

[23] These broader effects go beyond direct and indirect activity and are discussed in a qualitative manner.

action alternatives are anticipated to create or draw additional people to the area. These multipliers also assume that increases in coal production under any of the action alternatives would produce greater income (or wealth), driving associated changes in other industries in Delta and Gunnison Counties.

3.1 Alternative Assumptions

The main socioeconomic difference between the alternatives relates to the amount of coal production assumed to occur. Under the No-Action Alternative (Alternative A), lease agreements would not be issued for the Iron Point and Elk Creek tracts. Instead, remaining coal reserves, at the Bowie No. 2 and Oxbow operations would be completely mined out, and then mining operations are assumed to cease. The Bowie No. 2 Mine is estimated to have 1.5 years of reserves in the D coal seam. Oxbow has an estimated life of approximate 4 years with a continued annual extraction rate of five million tons. Oxbow plans to complete mining at the Sanborn Creek Mine, then move to develop the Elk Creek portal and mine coal reserves from their fee (private) land.

Under Alternative B, approximately 24 million tons of coal reserves would be mined from the Iron Point Coal Lease Tract and 21 million tons from the Elk Creek Coal Lease Tract. Both lease tracts would use longwall technology for coal extraction. It is estimated that the Iron Point reserves would be extracted at a rate of five million tons per year. The production rate would be at five million tons per year for the Elk Creek coal tract. These reserves would provide for approximately five years of mining at both the Iron Point and Elk Creek Coal Lease Tracts.

With Alternative C and, approximately 39 million tons of coal reserves would be available for mining at the Iron Point Tract and 23 million tons of reserves at the Elk Creek Tract. As with Alternative B, both mines would utilize longwall technology at similar annual extraction rates, but the higher amount of total reserves made available would result in longer life of the mines. The Iron Point Tract would be in operation for a time period estimated at about eight years; the Elk Creek Tract would be in operation for just under six years.

Additional capital expenditures are anticipated for coal extraction under any of the Action Alternatives (B, C and D). Identified capital expenditures anticipated for the Iron Point Coal Lease Tract include longwall equipment, new conveyor belt and upgrade of coal handling facilities and stockpiling, and ventilation. The Elk Creek Coal Lease Tract would be accessed through mine entries constructed on private surface (Elk Creek Portal). It is assumed for the analysis that existing longwall equipment at the Sanborn Creek Mine would be used for coal extraction from the Elk Creek Tract. The identified capital expenditures for both leases total an estimated $31 million. A portion of these capital expenditures are anticipated to occur within the local two-county area. Together, only 6% of the anticipated capital expenditures would be made in the local study area.[24]

For the Elk Creek Coal Lease Tract, it is anticipated that 30 to 40 construction workers would be needed to set up extraction activities. For this impact analysis, an average of 35 construction workers is applied. Construction is not anticipated to last more than one year; therefore, any socioeconomic effects would be short-lived.

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[24] Additional expenditures could be anticipated for the tertiary study area, particularly to mining suppliers located in or near Grand Junction.

Due to the region's established coal mining industry and data that identifies an existing base of construction workers, this analysis assumes that any construction workers needed are already living in the local study area. Therefore, there should be no need to attract new workers into the two-county study area. With no anticipation of additional mine workers needed, population, housing and school enrollments should remain unaffected by construction-related activity.[25]

Annual purchases to support administrative and mine operational needs would be made under any of the action alternatives. Combined annual purchases for any mining from the iron Point and Elk Creek Coal Lease Tracts are estimated at $49 million. It is anticipated that 20% of these annual operating purchases annually would be made within the local study area.

Under any of the action alternatives (Alternatives B, C and D), operations employment would not significantly increase above current conditions. Bowie plans to increase their work force from 157 (room and pillar mining) to 168 (longwall). Oxbow employment would remain constant at 215 employees. With no anticipation of significant additional mine workers needed for the lease tracts, population, housing and school enrollments for the action alternatives should be unaffected compared to current conditions.

According to data from the U.S. Bureau of Economic Analysis (BEA), construction workers of all types in the local study area earn, on average, $22,100 per year. However, BEA data does not specifically identify construction workers at mining operations. They are anticipated to earn more than the average construction work in the study area. Therefore, data from the IMPLAN model was used which identified an average wage for mining construction workers at $24,600.

IMPLAN model data was also used rather than BEA data to estimate the average wage of mine workers, contract operators, and reclamation personnel. BEA estimates that workers in the mining industry earned $53,300 on average compared to an annual estimated wage of $59,500 per employee with IMPLAN.[26]

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[25] These effects are discussed more in-depth under the alternative sections of this report.

[26] BEA data identified 631 mine workers within the local study area (as of 1996), which includes workers in all mining activities. IMPLAN estimates that there are 548 coal mine workers in the local study area as of 1996.

Table 15. Mine Development Assumptions for Each Alternative

	Iron Point Coal Lease Tract				Elk Creek Coal Lease Tract			
Assumption	Alt. A *	Alt. B	Alt. C	Alt. D	Alt. A	Alt. B	Alt. C	Alt. D
Years of Activity:								
Construction	-	1.0	1.0	1.0	-	1.0	1.0	1.0
Life of Mine	1.5	4.8	7.8	7.8	3.6	5.3	5.8	5.8
Reclamation	-	1.5	1.5	1.5	-	1.0	1.0	1.0
Mine Production (millions of tons):								
Total New Reserves	5.5	24.0	39.0	39.0	14.5	21.0	23.0	23.0
Annual Extraction	-3.7	5.0	5.0	5.0	-4.0	5.0	5.0	5.0
Employment:								
Construction	-	-	-	-	-	35	35	35
Mine Workers (FTE)	-168	168	168	168	-190	190	190	190
Contract Operators	-	-	-	-	-25	25	25	25
Reclamation	35	35	35	35	43	43	43	43
% Live in Local Study Area	89%	89%	89%	89%	94%	94%	94%	94%
Average Annual Wage:								
Construction	$24,600	$24,600	$24,600	$24,600	$24,600	$24,600	$24,600	$24,600
Mine Workers, Contract Operators, Reclamation	$59,500	$59,500	$59,500	$59,500	$59,500	$59,500	$59,500	$59,500

Note: Figures for Alternative A reflect activity at the Bowie #2 and Oxbow (Sanborn) mines respectively. Negative numbers reflect loss of employment as compared with current conditions (upon cessation of existing mine operations).

Source: E.D. Hovee & Company, August 1999.

3.2 Effects of the No-Action Alternative

Socioeconomic effects of the No-Action Alternative (Alternative A) would occur due to a reduction in coal mine activities within the local study area. Under the No-Action Alternative, mining of reserves at existing mines would continue at current extraction rates until reserves are depleted.

While each mine proponent has access to additional private reserves, these too, would eventually be depleted. Under a continued no action alternative, successful recovery of additional private reserves would extend mine life, but with eventual cessation of mine operations by the proponents. A decision to extract these additional private reserves has not been made, and probably will not occur, until reserves at existing mine operations are nearly depleted.

To be conservative, impacts associated with a No-Action Alternative are expressed as maximum potential effects on an annual basis after cessation of existing operations at the Bowie and Oxbow sites.

3.2.1 Employment and Income

Direct Effects. An estimated 168 workers would be employed for longwall mining at the Bowie No. 2 Mine. Under the No-Action Alternative, these employees would likely be laid off when existing coal reserves are depleted. Each mine worker earns, on average, an estimated $59,500 per year, translating into an annual payroll of nearly $10 million. At current production rates, the initial effects of these losses would not be experienced for another 18 months.

The Sanborn Creek Mine (Oxbow) employs 215 mine workers and contractors. Cessation of mine operations would translate to a loss of $12.8 million dollars in annual payroll, based an annual average wage estimated at $59,500 per worker.

Table 16. Forecast Annual Employment and Payroll Direct Effects (Alternative A — No-Action)

Operations Phase	Iron Point	Elk Creek	Combined*	Comments
Employment (average)	-168	-215	-383	Per alternative leasing agreements as discussed in Chapter 2 of this EIS.
Wages Paid per Employee	$59,500	$59,500	$59,500	As per 1996 MIG's IMPLAN database.
Estimated Payroll	-$9,996,000	-$12,792,500	-$22,788,500	

*Note: Combined effects show maximum potential loss in activity when Bowie No. 2 and Oxbow mines cease operations.

Source: E.D. Hovee & Company, based on information provided by proponents and IMPLAN data, August 1999.

Combined effects of discontinuing operations at the existing Bowie and Oxbow mines would represent loss of 383 jobs. Averaging $59,500 in annual salary, total lost annual payroll would approximate $22.8 million.

Indirect Effects. Using MIG's IMPLAN model, for every mine worker in the local study area, an estimated 1.7 workers are supported by mining operations and mine worker household purchases. With the Bowie No. 2 Mine, approximately 285 local non-mine workers are indirectly supported by current operations. The Oxbow operation is estimated to indirectly support another 365 local non-mine workers. If both mines were to close, then an estimated 650 locally-supported non-mine jobs in Delta and Gunnison counties could potentially be negatively affected (i.e., laid off, work time reduced, etc.) due to the cessation of mining activity.

IMPLAN estimates that for every $1.00 earned by mine workers, another $0.52 in income is supported in the local study area. This calculation means that the Bowie No. 2 Mine currently support up to $5.2 million in additional local income, while the Oxbow operation supports another $6.7 million in additional study area income. Closure of both mines could lead to a reduction of $11.9 million in non-mine related income throughout the affected study area.

Any losses of indirect study area employment or income would coincide with changes in study area mining activity. This is not anticipated to occur for at least 18 months, when it is assumed for this analysis that the Bowie No. 2 Mine would cease mining activity, followed by anticipated closure of the Sanborn mine two to three years later.

Table 17. Forecast Annual Employment and Payroll Indirect Effects (Alternative A —No-Action)

Operations Phase	Iron Point	Elk Creek	Combined*	Comments
Employment (average)	-285	-365	-650	A multiplier of 1.7 was used as derived from MIG's 1996 IMPLAN model.
Wages Paid per Employee	$18,200	$18,200	$18,200	As per 1996 MIG's IMPLAN database.
Estimated Payroll	-$5,197,900	-$6,652,100	-$11,850,000	A multiplier of 0.52 was used as derived from MIG's 1996 IMPLAN model.

*Note: Combined effects show maximum potential loss of activity when Bowie #2 and Sanborn mines cease operations..

Source: E.D. Hovee & Company, August 1999.

Total Effects. Total direct and indirect mine closure effects could represent a loss of up to 1,033 jobs and over $34.6 million in annual payroll.

Table 18. Forecast Annual Employment and Payroll Total Effects (Alternative A –No-Action)

Operations Phase	Iron Point	Elk Creek	Combined*	Comments
Employment (average)	-453	-580	-1,033	Sum of direct & indirect effects.
Wages Paid per Employee	$33,500	$33,500	$33,500	
Estimated Payroll	-$15,193,900	-$19,444,600	-$34,638,500	Sum of direct & indirect effects.

*Note: Combined effects show maximum potential loss of activity when Bowie #2 and Sanborn mines cease operations.

Source: E.D. Hovee & Company, August 1999.

If these jobs were not replaced, and if workers chose to remain in the two-county study area, the unemployment rate for Delta and Gunnison Counties combined could increase from the current rate of just over 5% to nearly 12%, at least short-term. The projected losses of over $34.6 million in annual payroll would not be fully realized as these workers would be eligible for unemployment payments, further increasing the percentage of local study area income derived from transfer payments.[27]

Paonia and Hotchkiss could expect to experience the effects most directly, as 56% to 67% of mine workers live in that area. The city of Delta also would be affected because local mine-related expenditures are largely made within the city.

This no-action alternative would involve a level of reclamation employment and payroll after cessation of mine operations similar to that of the action alternatives. Combined, the existing Bowie and Oxbow operations could be expected to support over 210 direct plus indirect jobs and nearly $7.1 million in payroll annually during reclamation. After reclamation has been completed, on-going monitoring would occur at both of these facilities.

Cumulative Effects. If affected workers left the two-county study area, a substantial number likely would choose to remain within the broader seven-county Central Western Slope area, as considerable inter-county migration occurs within the broader study area.[28] This might put pressure on other central western slope communities to create jobs for the workers displaced from employment in Delta and Gunnison counties, as well as provide community services.

3.2.2 Housing, Population and School Enrollment

For purposes of this analysis, it was assumed that each affected worker represents a separate household within the local study area. Demographic assumptions utilized to estimate population and school-age children are that household size averages 2.38 and school-age children (age 5-17) constitute 17.4% of the population.

Direct Effects. Of the 168 mine workers employed at Bowie No. 2 Mine, 150 are estimated to live within the local study area, representing 360 residents and 60 school-aged children. The 200 of 215 workers at the Oxbow operation that live in the local study area account for almost 480 local

27 The unemployment payments that these workers would receive cannot be determined because these payments are usually determined on a case-by-case basis.

28 According to IRS migration data for 1996-1997, almost 30% of residents leaving Delta County moved to other central western slope counties. Approximately 80% moved to neighboring Mesa and Montrose Counties.

area residents with over 80 school aged children. If both mines ceased operations, more than 800 residents (145 of school age) would be directly affected. Whether these children would remain enrolled in local schools would depend on whether parents choose to relocate elsewhere to find employment or remain in the local study area.

Table 19. Forecast Housing, Population and School Enrollment Direct Effects (Alternative A –No-Action)

Operations Phase	Iron Point	Elk Creek	Combined*	Comments
# of Households	-150	-200	-350	Each local worker is assumed to represent one separate household.
Estimated Population	-357	-476	-833	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	-62	-83	-145	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.

*Note: Combined effects show maximum potential loss of activity when Bowie #2 and Sanborn mines cease operations.

Source: E.D. Hovee & Company, August 1999.

Indirect Effects. Closure of the Bowie No. 2 Mine would indirectly affect approximately 680 residents and almost 120 school-age children. Closure of the Oxbow operations could indirectly affect almost 870 residents and 150 school-age children in the two-county study area. Over 1,500 local study area residents could be indirectly impacted if both mines were to close, which include almost 270 school-age children.

Table 20. Forecast Housing, Population and School Enrollment Indirect Effects (Alternative A –No-Action)

Phase of Work	Iron Point	Elk Creek	Combined*	Comments
Operations Phase:				
# of Households	-285	-365	-650	Each worker is assumed to represent one separate household.
Estimated Population	-678	-869	-1,547	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	-118	-151	-269	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.

*Note: Combined effects show maximum potential loss of activity when Bowie #2 and Sanborn mines cease operations.

Source: E.D. Hovee & Company, August 1999.

Total Effects. Closure of the Bowie No. 2 Mine could affect a combined direct and indirect population of almost 1,035 people. Closure of the Oxbow operations would affect an estimated 1,345 residents. Combined, these two mine closures could affect nearly 2,380 residents living in the local study area, over 410 of them school-aged children.

Table 21. Forecast Housing, Population and School Enrollment Total Effects (Alternative A — No-Action)

Operations Phase	Iron Point	Elk Creek	Combined*	Comments
# of Households	-435	-565	-1,000	Each worker is assumed to represent one separate household.
Estimated Population	-1,035	-1,345	-2,380	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	-180	-234	-414	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.

*Note: Combined effects show maximum potential loss of activity when Bowie #2 and Sanborn mines cease operations.

Source: E.D. Hovee & Company, August 1999.

If a significant portion of residents choose to migrate outside the two-county study area, the local housing market could experience at least a temporary downturn (e.g. decline in property values) because a large number of homes might come onto the market simultaneously, potentially driving down prices. Local schools also would be affected.

Cumulative Effects. With the No-Action Alternative, a significant portion of residents could be expected to relocate to other communities within the Central Western Slope Region. The number of low-income families living in the greater Central Western Slope area could also increase.

3.2.3 Other Community and Public Services

Beyond schools, a variety of other community and public services likely would be affected under the No-Action Alternative when mining operations are closed. Services may be affected due to changed service demands and/or reduce ability to fund required services.

Direct Effects. Over a short-term period of job loss (with mine cessation), needs for some community and public services could be expected to increase. Examples are law enforcement and social services. Over a longer term period, these effects may be diminished as displaced mine workers obtain alternative employment and/or relocate from the study area.

Indirect Effects. The economic multiplier relationship of direct to indirect employment could create further service demands from dislocation of workers currently supported by mining activity. A second type of indirect effect would result from reduced local tax revenues as local incomes declined and/or property values decline, whether temporarily or longer term.

Declining revenues would make it more difficult to fund community and public services at a time when they are more urgently needed. However, as with the direct effects, indirect effects might diminish over time as displaced workers find alternative employment and/or relocate from the primary/secondary study area.

Total Effects. Community and public service providers would be affected by this combination of direct and indirect effects. If not offset by alternative sources of revenue, the level of service available from existing providers would decline.

Cumulative Effects. If alternative employment were not available to displaced mine workers, some households could be expected to relocate to other communities in the tertiary central western slope area. This could increase demands for community and public service providers in the communities affected.

3.2.4 Fiscal Effects

The state of Colorado and local jurisdictions in Delta and Gunnison counties currently receive an estimated $11.4 million in combined annual tax revenue related to the Bowie and Oxbow operations and mine-related employees. Approximately 52% of this revenue is received by (and stays with) the state of Colorado; 48% is collected by or passes through to local jurisdictions in the secondary study area of Delta and Gunnison counties.

With cessation of mine operations, payment of tax revenues attributable directly to mine operations ($9.7 annually) would cease. A portion of the remaining $1.7 million in taxes attributable to mine workers might continue to be received, depending on factors such as ongoing employment for reclamation, unemployment payments while workers are displaced, and eventual ability to obtain re-employment, and need for relocation.

Fiscal consequences beyond direct effects are difficult to quantify due to the unpredictable outcome of decisions made by displaced mine workers.

3.2.5 Recreation, Social Values, Land Ownership and Values

Differing effects may be experience, based on such factors as the perspective of a particular individual or social group, geographic area considered, and time elapsed from implementation of a No-Action Alternative.

Effects that might be expected are varied, potentially including:

- Reduced recreation from those displaced directly or indirectly by mining cessation, perhaps offset in part by those using recreation lands for hunting or fishing activity.
- Diminution in income levels and quality of life for those displaced directly or indirectly from mine closure.
- Potential enhancements in quality of life for some residents whose economic livelihood is not related in any substantial way to mining activity; a specific example would be reduced train activity and associated noise and crossing blockages.
- For at least the short-term, property values might decline if a substantial proportion of displaced workers decided to place their homes on the market and relocate from the area. Changes in property ownership would be related to existing owners who decided to relocate.

Over time, cessation of mining would continue the trend toward in-migration of persons less dependent on traditional natural resource activities throughout Colorado's central western slope region. Rustic living households will transition to other economic and lifestyle social groupings. This could help stabilize property values over the long term.

3.3 Effects Common to All Action Alternatives

The primary socioeconomic difference between the action alternatives is related to the amount of coal reserves that would be available for mine extraction. Neither Bowie or Oxbow anticipates increasing employment levels significantly above what is already currently planned for their existing operations; consequently, there should be no major socioeconomic impacts (e.g.

additional employment levels, income, associated demographic characteristics, population, housing, or public school enrollments) anticipated under any of the action alternatives.

Leasing of federal coal is competitive. However, for purposes of this analysis, even if the applicants (Bowie and Oxbow) were not successful at securing the leases, the same workforce is assumed to be needed to the successful bidder for mining operations.

Because no significant increases or decreases in mine employment are anticipated, socioeconomic effects are discussed in terms of continuing support at the Bowie and Oxbow sites. This means the socioeconomic effects discussed in this section should be viewed as a continuation of existing effects and not as new impacts to the local study area. The effects common to all action alternatives are discussed below.

3.3.1 Employment and Income

Direct Effects. The Elk Creek Coal Lease Tract anticipates the need for 35 construction workers for the first 12 months of mine extraction. These workers are anticipated to earn $24,600, producing $861,000 in estimated payroll. It is assumed that no added construction workers are needed for the Iron Point Coal Lease Tract.

During the period of mine operations, it is assumed that 168 mine workers would be needed for the Iron Point Tract and 215 workers would be employed for the Elk Creek Tract. These workers are anticipated to earn an average $59,500 annually, yielding an estimated Iron Point payroll at $10.0 million annually and payroll of almost $12.8 million for the Elk Creek Tract. Total operations employment associated with the Iron Point and Elk Creek Coal Lease Tracts combined is 383 jobs with ongoing payroll of $22.8 million annually while both tracts are operational.

For reclamation and project decommissioning, it is estimated 30 to 40 workers would be needed for the Iron Point Tract. An average of 35 workers was used to assess the reclamation phase socioeconomic effects. It is estimated that 40 to 45 workers (including 5-10 mine employees and 30-40 contract workers) would be needed for the Elk Creek Tract; an average of 43 reclamation workers was assumed for this analysis. Reclamation is estimated to take 1.5 years for the Iron Point Tract and related facilities, while approximately one year would be required for reclamation work at the Elk Creek Tract and associated facilities.

Table 22. Forecast Annual Employment and Payroll Direct Effects

Phase of Work	Iron Point (B-D)	Elk Creek (B-D)	Iron Point & Elk Creek Combined (B-D)*
Construction Phase:			
Employment (average)	–	35	35
Wages Paid per Employee	–	$24,600	$24,600
Estimated Payroll	–	$861,000	$861,000
Operations Phase:			
Employment (average)	168	215	383
Wages Paid per Employee	$59,500	$59,500	$59,500
Estimated Payroll	$9,996,000	$12,792,500	$22,788,500
Reclamation Phase:			
Employment (average)	35	43	78
Wages Paid per Employee	$59,500	$59,500	$59,500
Estimated Payroll	$2,082,500	$2,558,500	$4,641,000

*Note: Combined effects show maximum potential activity when operations at Iron Point and Elk Creek tracts are underway at the same time. These illustrate the amount of activity expected to *continue* under the action alternatives and are *not* in addition to what is currently occurring.

Source: E.D. Hovee & Company, based on information provided by mine operators and IMPLAN data, August 1999.

Indirect Effects. Construction activities at the Elk Creek lease tract are estimated to support up to 0.33 workers in the local economy per construction worker employed at this facility.[29] Construction mining activities also support slightly more than $0.20 in indirect wages per dollar paid to construction workers at the Elk Creek facility.[30] This translates into a total of ten workers being supported in the local economy, yielding a payroll of $180,800.

It is estimated that every local study area coal mine operations or reclamation employee in the local study area support another 1.7 local workers. These mine workers also support another $0.50 of non-mine related income in the local study area per $1.00 paid to the mine workers.

The 168 workers employed fry the Iron Point Coal Lease Tract would support another 285 local workers that earn just under $5.2 million in annual income. The 215 mine workers for the Elk Creek Coal Lease Tract are estimated to support 365 workers, providing just under $6.7 million in annual income to the local economy. Taken together, the Iron Point and Elk Creek Coal Lease Tracts would support an estimated 650 indirect jobs with $11.8 million in annual payroll.

During reclamation, Iron Point Tract is estimated to support 60 workers in the local study area at a combined annual income of $1.1 million.[31] The Elk Creek Tract is estimated to support 75 local workers during the reclamation phase, with a combined annual income of over $1.3 million. An estimated 135 jobs are supported during the reclamation period at both mines, with payroll of up to $2.4 million annually.

[29] Economic employment multiplier comes from MIG's 1996 IMPLAN model for workers working in the new mineral extraction facilities sector.

[30] Ibid.

[31] Employment and income multipliers used in the operations phase also were used in estimating reclamation socioeconomic effects.

Table 23. Forecast Annual Employment and Payroll Indirect Effects

Phase of Work	Iron Point (B-D)	Elk Creek (B-D)	Iron Point & Elk Creek Combined (B-D)*
Construction Phase:			
Employment (average)	—	10	10
Wages Paid per Employee	—	$18,100	$18,100
Estimated Payroll	—	$180,800	$180,800
Operations Phase:			
Employment (average)	285	365	650
Wages Paid per Employee	$18,200	$18,200	$18,200
Estimated Payroll	$5,197,900	$6,652,100	$11,830,000
Reclamation Phase:			
Employment (average)	60	75	135
Wages Paid per Employee	$18,000	$17,700	$17,900
Estimated Payroll	$1,082,900	$1,330,400	$2,413,300

*Note: Combined effects show maximum potential activity when operations at Iron Point and Elk Creek tracts are underway at the same time. These illustrate the amount of activity expected to *continue* under the action alternatives and are *not* in addition to what is currently occurring.

Source: E.D. Hovee & Company, using IMPLAN multipliers for construction and coal mining activity, August 1999.

Total Effects. During construction associated with the Elk Creek Coal Lease Tract, a total of 45 local workers would be supported over an approximate one-year time frame. It is estimated that just over $1 million in annual income would be generated. During operations, Iron Point Coal Lease Tract would be expected to support more than 450 local workers and income of almost $15.2 million annually in the local study area. The Elk Creek Coal Lease Tract would be estimated to support 580 jobs at an annual local income of over $19.4 million. During periods when mining is occurring on both lease tracts at the same time, the mining activities are estimated to support over 1,000 direct and indirect jobs in the local economy and over $34.6 million in annual local income.

During reclamation, it is estimated that about 95 workers with an annual income of $3.2 million would be required for the Iron Point Coal Lease Tract. Elk Creek is estimated to support nearly 120 workers at an annual income of almost $3.9 million. Combined, these facilities will support over 210 workers and income of nearly $7.1 million annually during reclamation. Iron Point reclamation is anticipated to take 1.5 years, while Elk Creek is estimated to take somewhat less than one year. After reclamation has been completed, ongoing environmental and reclamation monitoring would occur for both facilities.

3.3.2 Housing, Population and School Enrollment

In evaluating the continuing housing, population and school enrollment effects, it has been assumed that each worker represents a separate household within the local study area. Furthermore, because this study area historically has experienced coal mining activity, it is assumed that the workers in question continue to live at their current place of residence for all phases of mining-related activity.[32] Therefore, the development of either facility is not anticipated to attract added labor force (or population) from outside the two-county local study area.

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[32] This assumption is confirmed by payroll data indicating residence locations for current Bowie and Oxbow employees as presented in the affected environment section of this EIS.

Table 24. Forecast Annual Employment and Payroll Total Effects

Phase of Work	Iron Point (B-D)	Elk Creek (B-D)	Iron Point & Elk Creek Combined (B-D)*
Construction Phase:			
Employment (average)	–	45	45
Wages Paid per Employee	–	$23,200	$23,200
Estimated Payroll	–	$1,041,800	$1,041,800
Operations Phase:			
Employment (average)	453	580	1,033
Wages Paid per Employee	$33,500	$33,500	$33,500
Estimated Payroll	$15,193,900	$19,444,600	$34,605,500
Reclamation Phase:			
Employment (average)	95	118	213
Wages Paid per Employee	$33,300	$33,000	$33,000
Estimated Payroll	$3,165,400	$3,888,900	$7,054,300

*Note: Combined effects show maximum potential activity when operations at Iron Point and Elk Creek Tracts are underway at the same time.

Source: E.D. Hovee & Company, using IMPLAN multipliers for construction and coal mining activity, August 1999.

As with Alternative A, the 1997 average household size (2.38 persons per household) for the two-county study area is used to estimate the affected population. The proportion of school age population (17.4%) for the two-county area in 1997 is also applied to estimate affected school enrollments.

As with the employment and income effects, the housing, population, and school enrollment effects are presented as a continuation of existing effects and not as new impacts to the local study area. They are used for illustration purposes to indicate the level of socioeconomic activity that the two new mine facilities would continue to support.

Direct Effects. Construction workers associated with the Elk Creek Tract are estimated to represent 35 households. Based on the local study area's average household size, these households would account for over 80 current residents that are estimated to have 14 school age children between them. Based on IMPLAN data, over 50 workers in the new mineral extraction facility sector were identified as working within the two-county area; therefore, it is assumed that most if not all of these workers already live in the secondary study area.

It is assumed that 150 out of the168 workers to be employed for mining of the iron Point Tract would continue to live within the local study area; they are estimated to represent almost 360 persons with 60 of school age. The 215 workers associated with the Elk Creek Tract are estimated to represent 480 local residents with nearly 80 of school age.[33]

The 35 reclamation workers associated with the Iron Point Tract are anticipated to be workers that were employed during the operational phase and who would remain for reclamation work. These workers would account for a little more than 80 local residents with 14 school age. The 43 mine reclamation workers for the Elk Creek Tract are estimated to represent just over 100 local study area residents with 18 of school age.

33 Enrollment figures represent estimated conditions based on characteristics of study area population rather than actual school enrollment associated with mine employees at any particular point in time, whether currently or prospectively.

Table 25. Forecast Housing, Population and School Enrollment Direct Effects

Phase of Work	Iron Point (B-D)	Elk Creek (B-D)	Combined (B-D)*	Comments
Construction Phase:				
# of Households	–	35	35	Each worker is assumed to represent one separate household.
Estimated Population	–	83	83	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	–	14	14	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.
Operations Phase:				
# of Households	150	200	350	Each local worker is assumed to represent one separate household.
Estimated Population	357	476	833	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	62	83	145	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.
Reclamation Phase:				
# of Households	35	43	78	Each worker is assumed to represent one separate household.
Estimated Population	83	102	185	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	14	18	32	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.

*Note: Combined effects show maximum potential activity when operations at Iron Point and Elk Creek tracts are underway at the same time.

Source: E.D. Hovee & Company, using IMPLAN multipliers for construction and coal mining activity, August 1999.

Taken together, an estimated 350 households with 833 residents and 145 school age children are assumed for both the Iron Point and Elk Creek Tracts. This drops to 78 households with 185 residents (32 school age children) during the subsequent period of site reclamation and closure work.

Indirect Effects. The ten local workers supported by construction workers at the Elk Creek are estimated to represent almost 25 existing local residents with four being school age children.

The 285 local workers supported indirectly by Iron Point operations are estimated to represent 680 residents with just under 120 of school age. The Elk Creek operations are estimated to indirectly support 365 local workers; they represent approximately 870 residents with just over 150 estimated to be school age children.

Approximately 60 local workers would be indirectly supported by reclamation activities at Iron Point. They represent over 140 residents with 25 of school age. The 75 workers being indirectly supported in the local area due to Elk Creek reclamation activities are estimated to represent almost 180 residents with approximately 30 of school age.

Table 26. Forecast Housing, Population and School Enrollment Indirect Effects

Phase of Work	Iron Point (B-D)	Elk Creek (B-D)	Combined (B-D)*	Comments
Construction Phase:				
# of Households	–	10	10	Each worker is assumed to represent one separate household.
Estimated Population	–	24	24	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	–	4	4	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.
Operations Phase:				
# of Households	285	365	650	Each worker is assumed to represent one separate household.
Estimated Population	678	869	1,547	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	118	151	269	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17. Represents no net increase over current conditions.
Reclamation Phase:				
# of Households	60	75	135	Each worker is assumed to represent one separate household.
Estimated Population	143	179	322	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	25	31	56	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.

*Note: Combined effects show maximum potential activity when operations at Iron Point and Elk Creek tracts are underway at the same time.

Source: E.D. Hovee & Company, using IMPLAN multipliers for construction and coal mining activity, August 1999.

Together, the two mines would be indirectly support 650 households with close to 1,550 residents and 270 students. During reclamation, this would decline to 135 households, total population of less than 325 and just over 55 students.

Total Effects. During the 12 months of construction associated with the Elk Creek Tract, it is estimated that nearly 110 residents with almost 20 school aged children would be supported by activities related to preparing the facility for operations. Due to the relatively short duration of the construction phase and the assumption that the workers already live in the local study area, the seven-county central western slope area is not expected to be impacted in terms of socioeconomic factors including changes to underlying social values or land ownership/values.

Iron Point operations are estimated to continue to support nearly 1,040 residents with 180 of school age. Elk Creek is anticipated to continue to support 1,350 residents annually and 230 being school-aged children. These effects are anticipated to continue for 5 to 8 years at Iron Point and 5 to 6 years at Elk Creek.

A reduced number of residents would continue to be supported by mine-related activity after mining operations cease during the reclamation phase. At Iron Point, a total of 230 residents, less than 40 of school age, would be supported. At Elk Creek, it is estimated that over 280 residents would be supported during reclamation, nearly 50 of school age.

Table 27. Forecast Housing, Population and School Enrollment Total Effects

Phase of Work	Iron Point (B-D)	Elk Creek (B-D)	Combined (B-D)*	Comments
Construction Phase:				
# of Households	–	45	45	Each worker is assumed to represent one separate household.
Estimated Population	–	107	107	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	–	18	18	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.
Operations Phase:				
# of Households	435	565	1,000	Each local worker is assumed to represent one separate household.
Estimated Population	1,035	1,345	2,380	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	180	234	414	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.
Reclamation Phase:				
# of Households	95	118	213	Each worker is assumed to represent one separate household.
Estimated Population	226	281	507	Assumes the current average 1997 household size of 2.38 persons for the two-county study area.
School Enrollment	39	49	88	Assumed to represent the 1997 percentage (17.4%) of population that is age 5-17.

*Note: Combined effects show maximum potential activity when operations at Iron Point and Elk Creek tracts are underway at the same time.

Source: E.D. Hovee & Company, using IMPLAN multipliers for construction and coal mining activity, August 1999.

During peak operations, the Iron Point and Elk Creek Tracts would support an estimated 1,000 households, translating into 2,380 residents with over 410 school age children. With reclamation, the number of households supported directly and indirectly by these mines drops to just over 210 and 500+ residents with less than 90 school age children.

3.3.3 Other Community and Public Services

During operations, annually recurring effects are expected to be similar for each of the action alternatives (B, C and D). The primary difference is associated with anticipated duration of mine operations, with Alternatives C and D occurring over a longer time period than Alternative B.

During the period of mine operations, effects on community and public service providers generally could be expected to involve little to no change from current conditions. This is because mine operation employment associated with mining of the Iron Point and Elk Creek Coal Lease Tracts would essentially be the same as at the existing Bowie and Oxbow operations. Upon eventual cessation of mine operations, effects would be comparable to those described in Alternative A.

3.3.4 Recreation, Social Values and Land Ownership

As with Alternative A, differing effects may be experienced with Alternatives B, C and D. For the Action Alternatives, effects may vary depending on such factors as the perspective of a particular individual or social group, geographic area considered, and time elapsed from implementation.

Effects might include:

- Continued recreation opportunity for existing residents and visitors, but with some potential reduced opportunity for recreation on federal lands in the vicinity of the Iron Point and Elk Creek Coal Lease Tracts.

- Maintenance of incomes, quality of life and social values of existing mine workers and other workers or businesses that benefit indirectly from mine-related activity.

- Potential diminution of quality of life and social values for some residents whose economic livelihood is not related in any substantial way to mining activity; a commonly cited example is increase train activity and associated noise and crossing blockage.

- No change in property values or ownerships would be expected due to mine operations over the period of their continuation. Any changes would be attributed to other external market conditions and typical patterns of turnover in real estate ownership.

Alternatives B, C and D would involve continued mining for a period of approximately 5 to 8 years beyond what is expected with Alternative A. It is conceivable that the life of affected North Fork mines could be extended further if operators successfully secure previously unmined coal reserves on private lands or added federal leases.

Continued mining offers opportunity to maintain the social values of primary and secondary study area households that depend on or relate to extractive natural resource-related industries. Delta County, in particular, likely could continue to maintain an economic and lifestyle profile different from that of other central western slope counties in Colorado through the period of ongoing mining activity.

3.4 Multi-Year Socioeconomic

Annual socioeconomic effects under each action alternative are anticipated to produce similar socioeconomic effects on an annual basis. However, because the amount of coal reserves and associated duration of each alternate lease agreement differs between alternatives, multi-year effects are evaluated in order to discuss the total potential impact expected to continue to occur in the local study area. These too are presented for illustrative purposes in order to identify the expected level of socioeconomic activity anticipated to be continually supported over the life of both mines.

Multi-year effects are calculated by estimating the annual effects of each phase of development, multiplying the annual effects by the anticipated duration (i.e. number years) of each phase, and adding the multi-year effects of each phase together. For example, a mine expected to support 10 workers during one year of construction, 100 workers during five years of operations, and 40 workers during three years of reclamation would result in 630 employee years (10 x 1 + 100 x 5 + 40 x 3 = 630) of job-related activity. *Note:* Employee effects are expressed in terms of employee years, pay in terms of total income generated over the life of the entire mine activities, and population in terms of person years.

3.4.1 Multi-Year Effects of Alternative A (No-Action Alternative)

There would be no multi-year effects for Alternative A. No mining would occur from either the iron Point or Elk Creek Coal Lease Tracts.

3.4.2 Multi-Year Effects of Alternative B

An estimated 24 million tons of coal would be mined from the Iron Point Coal Lease Tract at a rate of five million tons per year. At this rate of production, mining from the Iron Point Tract would take approximately 5 years. After the reserves have been mined, reclamation would proceed, taking an estimated 1.5 years.

An estimated 21 million tons of coal would be mined from the Elk Creek Coal Lease Tract at a rate of four million tons per year. At this rate, mining would occur for just over five years. For purposes of this analysis, it was assumed that construction activities would take approximately 12 months. Reclamation associated with the Elk Creek Tract is estimated at 12 months.

It is estimated that the continued multi-year effects of mining from the Iron Point Tract would produce just under 900 employee years and generate a total income of $53.2 million over the life of the mine. Total multi-year population effects would result in just over 1,900 person years.

It is estimated that continued multi-year effects of mining from the Elk Creek Tract would produce just over 1,200 employee years and generate a total income of $70.6 million over the life of this mine. Total multi-year population effects would result in just under 2,700 person years.

Taken together, the mining operations involving the Iron Point and Elk Creek Coal Lease Tracts would offer over 2,100 employment-years, $124 million in multi-year payroll, and 4,605 person years of local population supported.

Table 28. Multi-Year Employment, Income and Population Direct Effects (Alternative B)

Direct Effects	Iron Point	Elk Creek	Combined
Total Employment Years	894	1,207	2,101
Multi-Year Payroll	$53,187,050	$70,580,125	$123,767,175
Total Person Years (population)	1,921	2,684	4,605

Source: E.D. Hovee & Company, based on Alternative B reasonably foreseeable scenario, August 1999.

Alternative B would also have multi-year indirect impacts. It is estimated that mining from both lease tracts would continue to support over 3,500 employee years, generate a total payroll of $64 million, and a residential population base of 8,400 person years.

Table 29. Multi-Year Employment, Income and Population Indirect Effects (Alternative B)

Indirect Effects	Iron Point	Elk Creek	Combined
Total Employment Years	1,518	2,001	3,519
Multi-Year Payroll	$27,657,170	$36,434,725	$64,091,895
Total Person Years (population)	3,612	4,765	8,377

Source: E.D. Hovee & Company, based on Alternative B reasonably foreseeable scenario, August 1999.

The combined direct and indirect multi-year effects that are anticipated to be continually supported by Alternative B result in over 5,600 employee years, a total cumulative income of $187.9 million, and total estimated 13,000 person years (of population supported).

Table 30. Multi-Year Employment, Income and Population Total Effects (Alternative B)

Cumulative Effects	Iron Point	Elk Creek	Combined
Total Employment Years	2,412	3,208	5,620
Multi-Year Payroll	$80,844,220	$107,014,850	$187,859,070
Total Person Years (population)	5,533	7,449	12,982

Source: E.D. Hovee & Company, based on Alternative B reasonably foreseeable scenario, August 1999.

3.4.3 Multi-Year Effects of Alternative C and D

With Alternative C, an estimated 41 million tons of coal would be mined from the Iron Point Coal lease Tract at a rate of five million tons per year. At this rate of production, the life of mining from the Iron Point Tract would be about eight years. It is assumed that development activities for the Iron Point Tract would take no more than 1 year, and after the reserves have been mined, reclamation would proceed, taking approximately 1.5 years.

For Alternative C, an estimated 23 million tons of coal would be mined at a rate of five million tons per year. The life of the mining from the Elk Creek Tract would be less than six years. Once again, construction activities for the Elk Creek Tract are assumed to take approximately 1 months. Reclamation also is estimated at 12 months.

Alternative D anticipates extraction of coal resources and an operating period comparable to that of Alternative C. Consequently, both Alternatives C and D are viewed as having comparable multi-year effects.

With either Alternative C or D, it is estimated that multi-year effects of mining from the Iron Point Tract would continue to produce just under 1,400 employee years and generate a total income of $83.2 million. Total multi-year population effects would result in a population supported of just under 3,000 person years.

It is estimated that multi-year effects of mining from the Elk Creek Tract would continue to produce just over 1,300 employee years and generate a total income of $77 million. Total multi-year population effects would result in just over 2,900 person years.

Table 31. Multi-Year Employment, Income and Population Direct Effects (Alternatives C and D)

Direct Effects	Iron Point	Elk Creek	Combined
Total Employment Years	1,398	1,314	2,712
Multi-Year Payroll	$83,175,050	$76,976,375	$160,151,425
Total Person Years (population)	2,992	2,922	5,914

Source: E.D. Hovee & Company, based on Alternative C and D reasonably foreseeable scenario, August 1999.

As with Alternative B, Alternatives C and D would also continue to support multi-year indirect impacts. It is estimated that both facilities combined would have a multi-year effect that would continue to generate close to 4,600 employee years, a total payroll of $83 million, and a residential population base of almost 11,000 person years.

Table 32. Multi-Year Employment, Income and Population Indirect Effects (Alternative C and D)

Indirect Effects	Iron Point	Elk Creek	Combined
Total Employment Years	2,373	2,184	4,557
Multi-Year Payroll	$43,250,870	$39,760,775	$83,011,645
Total Person Years (population)	5,646	5,200	10,846

Source: E.D. Hovee & Company, based on Alternative C and D reasonably foreseeable scenario, August 1999.

The combined direct and indirect multi-year effects could include almost 7,300 employee years, a total cumulative income of $243.2 million, and a total estimated population supported equivalent to almost 16,800 person years.

Table 33. Multi-Year Employment, Income and Population Total Effects (Alternatives C and D)

Cumulative Effects	Iron Point	Elk Creek	Combined
Total Employment Years	3,771	3,498	7,269
Multi-Year Payroll	$126,425,920	$116,737,150	$243,163,070
Total Person Years (population)	8,638	8,122	16,760

Source: E.D. Hovee & Company, based on Alternative C and D reasonably foreseeable scenario, August 1999.

3.5 Fiscal Effects for All Alternatives

Unlike the other socioeconomic effect sections of this report, only fiscal effects directly related to the mining activity on the two lease tracts are estimated. Estimating indirect, total, and cumulative fiscal effects is more problematic and not easily quantified. While some level of impact additional to the estimated direct effects would be generated, it is not anticipated to be of any substantial level compared to the direct effects.

Major revenue sources anticipated to be lost (No-Action Alternative) or generated (Action Alternatives B, C, and D) under each alternative include federal royalties, state severance tax, state and local sales tax, and property taxes

Each source is distributed to different jurisdictions (or taxing authorities) and has very specific allocation schedules as well as uses. Federal revenue and state regulations govern how each tax is calculated, distributed, and used. Primary sources include:

- **Federal Royalties.** Calculated using the amount of coal extracted and the most current market value (or spot price) of coal. The tax rate established by the federal government for underground mined coal is 8%. One-half of the federal royalties are returned to the state that produced the coal. The state of Colorado has established a special mineral leasing fund. Twenty-five percent of this fund is allocated to state public schools, 50% to locally impacted jurisdictions, 10% to the Colorado water conservation board construction fund, and 15% to the local energy impact fund. Funds are designated to be used for planning, construction, and maintenance of public facilities or for public services.

- **Colorado State Severance Tax.** Calculated using the annual amount of coal produced, after the first 32,000 tons.[34] The tax rate is $0.54 per ton, but the first

[34] As of July 1, 2000, the first 8,000 tons per quarter are exempt. Currently, the exemption is the first 25,000 tons per quarter (CRS 39-29-106).

32,000 tons are exempt and a 50% credit is given to underground mines. Half of the tax funds collected are distributed to the Department of Natural Resources (for natural resource replacement or state water conservation) and the other half is allocated to the local severance tax fund. Eighty-five percent of funds allocated to the local severance tax is distributed to affected jurisdictions for planning, construction, and maintenance of public facilities or for public services. The other 15% is distributed to counties or municipalities based on mine workers place of residence and can be used for discretionary purposes.

- **Sales Taxes.** Assessed on most non-essential household goods. Funds are deemed discretionary and can be spent on any need by state or local government. The state of Colorado rate is 3%. For this EIS, the city of Delta has a local sale tax rate of 3% which is also used because local expenditures by mine operators and a significant portion of household expenditures occur within the city of Delta.[35]

- **Property Taxes.** Levied by taxing districts that have been established by local voters. Levy rates vary by district and are usually expressed in terms of per $1,000 of taxable assessed value. Delta County levies a rate of $18.082, Gunnison County $13.179, Delta County Joint School District #50 $32.520, Paonia Cemetery District $1.000, Colorado River Water District $0.309, North Fork Water District $0.612, Delta County Memorial Hospital $1.730, Delta County Library $2.924, and North Fork Pool and Recreation District $1.379. Facilities located in Delta County are assessed at a combined levy rate of $58.556, with assessment of $46.620 for facilities in Gunnison County. While these tax rates appear extraordinarily high, only 29% of the value of a property is assessed as prescribed under state law.

3.5.1 Fiscal Effects of Alternative A (No-Action Alternative)

The Bowie No. 2 and Oxbow mines would produce a total of 10 million tons of coal per year. Average market value of coal is assumed at $18.50, the average sales price in 1997. Current purchases for operations approximate $49 million with an assumption that 20% of purchases are made locally (primarily in the city of Delta).

A substantial amount of revenue that the state and local jurisdictions rely on to provide services likely would be lost if the two coal leases are not issued. It is estimated that annual revenues lost by federal royalties from the two lease tracts would be over $5.7 million.

An estimated $2.1 million in annual state severance tax would be lost, of which 50% would have been scheduled to be available to local jurisdictions. Also, an annual $1.8 million in sales tax would not be generated; almost $330,000 would have been distributed to local jurisdictions.

The substantial reduction in tax revenues could place a burden on local service providers. If the affected residents remain in the two-county study area, then providers that rely the most on mining tax revenues may need to make cuts in the services they provide, lower their level of services, or find alternative replacement funding .

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35 Sales tax rates for individual jurisdiction was also presented in Section 2.0, Affected Environment, in this report.

Total reduction in annual revenue is estimated at $5.9 million for state government and $5.5 million to affected local governments, or $11.4 million in combined state and local government revenue. An estimated $1.7 million in reduced revenue could also occur as a result of reduced personal income.

3.5.2 Fiscal Effects of Action Alternatives (B, C and D)

Taken together, mining production from the Iron Point and Elk Creek Coal Lease Tracts is projected to produce a combined 10 million tons of coal per year. Market value of coal is assumed at $18.50 per ton, the average sales price in 1997.

Capital expenditures for this mining are estimated at $31.0, with less than 6% being purchased locally. Current purchases for operations are assumed at $49 million with an assumption that 20% of purchases are made locally (primarily in the city of Delta).

Approximately 92% of mine employees are estimated to live within the local study area. Approximately 50% of the mining activity on the Elk Creek Tract would occur in Delta County; all other mining activity is allocated to Gunnison County. The entire Iron Point Coal Lease Tract is located in Delta County.

Annual revenues generated from coal production from the two lease tracts would result in almost $6.7 million of federal royalties.

An estimated $2.4 million in annual state severance tax also would be generated. Based on current allocations, 50% would be distributed to the local study area, with the majority of the 15% local distribution returning to the cities of Paonia and Hotchkiss.

An annual $1.8 million in sales tax would be generated by annual mine operation purchases, almost $330,000 being anticipated for the city of Delta. Anticipated capital expenditures for the mining activities are estimated to generate almost $1.0 million dollars in sales tax. Approximately $60,000 is projected to be captured by the city of Delta.

Construction workers are expected to continually generate $13,600 annually in property taxes. Mine operation workers are estimated to generate $136,700 annually, with an estimated $30,300 for reclamation employees.

Mining from the two lease tracts is anticipated to generate $807,400 to $866,800 in property taxes annually. The majority (75%) would be allocated to Delta County taxing districts, with the remainder going to Gunnison County districts. The Delta County Joint School District #50 would receive 55% of the property taxes generated in Delta County and almost 70% in Gunnison with the remainder going to Gunnison County districts. The Delta County Joint School District #50 would receive 55% of the property taxes generated in Delta County and almost 70% in Gunnison County. Each County government would receive approximately 30% of property taxes generated within their jurisdictions.

Under any of the action alternatives, local service providers are not anticipated to be negatively effected. Revenues generated should ensure continuation of community and public services to a level at least commensurate with current levels of service.

Table 34. Direct Fiscal Effects by Action Alternative During Operations

Revenue Sources	Annual Effects Alt. B	Annual Effects Alt. C-D	Multi-Year Effects Alt. B	Multi-Year Effects Alt. C-D
Construction Phase (one year only):				
Sources Related to Mine:				
Sales Tax from Capital Purchases				
- State Assessment	$930,000	$930,000	$930,000	$930,000
- Local Assessment	$59,900	$59,900	$59,900	$59,900
Sources Related to Construction Workers:				
State Income Tax	$43,100	$43,100	$43,100	$43,100
Sales Tax				
- State Assessment	$27,200	$27,200	$27,200	$27,200
- Local Assessment	$27,200	$27,200	$27,200	$27,200
Property Tax	$13,600	$13,600	$13,600	$13,600
Subtotal State & Local Revenues	$1,101,000	$1,101,000	$1,101,000	$1,101,000
Operations Phase (annually recurring):*				
Sources Related to Mine:				
Federal Royalties	$6,660,000	$6,660,000	$33,300,000	$45,880,000
Severance Tax	$2,421,400	$2,421,400	$12,141,400	$16,731,400
Sales Tax from Purchases				
- State Assessment	$1,470,000	$1,470,000	$7,542,000	$9,252,000
- Local Assessment	$328,500	$328,500	$1,698,300	$2,008,800
Property Tax	$807,400	$866,800	$4,133,000	$6,261,400
Sources Related to Mine Workers:				
State Income Tax	$1,139,400	$1,139,400	$5,757,100	$7,576,300
Sales Tax				
- State Assessment	$298,100	$298,100	$1,506,000	$1,982,000
- Local Assessment	$273,700	$273,700	$1,384,300	$1,812,000
Property Tax	$136,700	$136,700	$691,700	$905,500
Subtotal State & Local Revenues	$13,535,200	$13,594,600	$68,153,800	$92,409,400
Reclamation Phase (annually recurring):*				
Sources Related to Mine:				
Sales Tax from Purchases				
- State Assessment	-	-	-	-
- Local Assessment	-	-	-	-
Sources Related to Reclamation Workers:				
State Income Tax	$232,100	$232,100	$232,100	$232,100
Sales Tax				
- State Assessment	$60,700	$60,700	$101,600	$101,600
- Local Assessment	$60,700	$60,700	$101,600	$101,600
Property Tax	$30,300	$30,300	$50,800	$50,800
Subtotal State & Local Revenues	$383,800	$383,800	$486,100	$486,100
Total Multi-Year Revenues	-	-	$69,740,900	$93,996,500

* Note: Combined annual effects show maximum potential activity when operations at Iron Point and Elk Creek Tracts are underway at the same time. Multi-year effects are in addition to what can be expected with Alternative A.

Source: E.D. Hovee & Company, August, 1999.

Average annual revenues directly associated with Alternatives B, C, and D for state and local jurisdictions combined are estimated at $1.1 million during construction, $13.5 to $13.6 million during operations, and $383,800 for the period of reclamation. The local government share of total revenues received would be 9% during construction, 52% for operations, and 24% with reclamation.

Total multi-year revenues to state and local governments are estimated at close to $70 million with Alternative B and $94 million with Alternatives C-D. Multi-year revenues are 35% greater with Alternatives C and D than with Alternative B due to the longer duration of mining activity.

The local government share of total revenues received is 51% with Alternative B and 53% with Alternatives C and D.

3.6 Supplemental LEIFA Analysis

Based on a number of comments on the North Fork Coal Draft EIS, E.D. Hovee & Company completed a supplemental economic impact exercise that incorporated Local Economic Information and Forecasting Assistance (LEIFA) data into the IMPLAN model to produce a separate set of economic impact multipliers that are driven by LEIFA data. Non-proprietary LEIFA data was obtained from the Colorado State Demography Section.

The first step in modifying the impact model was to aggregate the 526 detailed IMPLAN economic sectors into the disclosed 40 LEIFA sectors. Only non-proprietary LEIFA data was used; non-disclosable proprietary data has not been applied to the model revisions. Please see Table 35, Comparison Between IMPLAN and LEIFA Data Sheets.

After adjusting the IMPLAN model to reflect LEIFA sectors, the wage and proprietor income components were adjusted to correspond with LEIFA employment and earnings income data. Next, industry output and other value-added data were adjusted into 1997 dollars using industry price inflators available in the IMPLAN model, as the most up-to-date and original IMPLAN data used for the Draft EIS was for 1996. All model adjustments were made in consultation with Minnesota IMPLAN Group to ensure that appropriate revisions were made to avoid incorrect model adjustments or biasing the impact results.

The greatest adjustments made to the IMPLAN model occur within the agriculture production sector (i.e., crops and livestock), where over 2,000 employees were added and over $14.9 million in earnings income was removed. The LEIFA data indicate that the agriculture production sector has nearly 3,000 jobs while the IMPLAN data set indicated employment of 953. This compares to 1997 BEA data that suggests that there are 1,500 farm related employees and Colorado State Employment Security Department identifying only 500 total agricultural workers. Also noted is that the 1997 Census of Agriculture, typically viewed as one of the most complete sources of agriculture data, identified just over 1,900 jobs, with three-quarters of these employees working less than 150 days per year.

Other sectors experiencing large employment gains with LEIFA data (compared to IMPLAN) include eating and drinking establishments with an additional 639 jobs, followed by business services (+322 jobs), state and local government (+228 jobs), and coal mining (+119 jobs). Sectors experiencing relatively large job losses compared to the IMPLAN data set include engineering and management services with a loss of 307 jobs followed by financial services (-243 jobs), miscellaneous retail (-163 jobs), and personal services (-124 jobs).

The LEIFA data adjustments resulted in an additional 2,635 jobs and a loss of over $88.6 million in earnings income for Delta and Gunnison Counties combined. Of particular interest are the adjustments made to the agricultural production sector where LEIFA data estimates 2,000 more jobs and $14.9 million less in income than is the case with the IMPLAN data. This is offset somewhat by lower LEIFA estimates of employment in health care, specialty retail and some professional service sectors that is indicated by IMPLAN data.

The LEIFA data results in a lower employment multiplier (2.45 vs. 2.70) but a larger income multiplier (2.62 vs 2.52) than is estimated for the Draft EIS and Final EIS using IMPLAN data. The lower employment multiplier is a direct result of LEIFA data recording higher levels of

agricultural employment offset somewhat by lower levels of employment in the health care, specialty retail, and some professional service sectors.

The Draft EIS indicated that the No-Action Alternative would result in a total direct plus indirect loss of 1,033 jobs and $34.6 million in tow-county income. The LEIFA adjusted model estimates a total job loss of 938 workers and income loss of $36.9 million.

The Draft EIS concluded that the action alternatives would lead to a maintenance of current conditions rather than to additional employment or income above and beyond what is currently experienced. This conclusion is not altered by the inclusion of the LEIFA data set.

The results of the LEIFA adjusted IMPLAN model do not produce materially significant results from those presented in the Draft EIS, LEIFA results are within 10% of Draft EIS estimates. The LEIFA data set appears to be at variance with other, standard published economic data sources. Consequently, the IMPLAN data set applied in the Draft EIS is retained with this Final EIS document; however, this supplemental analysis provides a comparison with economic data from LEIFA.

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Appendix M

Air Quality Impact Assessment

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1.0 INTRODUCTION

This appendix provides detailed emission estimates and air quality dispersion modeling to support the air quality impact assessments completed for the North Fork Coal Environmental Impact Statement (EIS). The air dispersion modeling focuses on "air quality related values" (acid deposition and visibility) at two Class I areas near the Bowie Resources Ltd. (Bowie) and Oxbow Mining (Oxbow) operations. The two Class I areas are West Elk Wilderness Area and Black Canyon of the Gunnison National Park. It is assumed by this analysis that there would be no air quality impacts to the Ragged Wilderness from the coal mines in the North Fork of the Gunnison River Valley.

Neither the Oxbow nor the Bowie operations are subject to Prevention of Significant Deterioration (PSD) permitting. This appendix analyses the fugitive dust and tailpipe emissions from the Oxbow and Bowie operations, as well as Mountain Coal Company's West Elk Mine (West Elk Mine), and assesses their possible impacts the Class I areas. The following wilderness area receptors were used in the analysis:

- Acid deposition impacts evaluated at South Golden Lake at the northern part of West Elk Wilderness approximately 9 miles from the historic town of Bowie
- Regional haze evaluated at the northwest boundary of West Elk Wilderness (11 miles from the historic town of Bowie) and the northeast corner of Black Canyon National Park
- Plume blight from the Bowie No. 2 Mine evaluated for a viewer on top of Mt. Gunnison (at the northwest part of West Elk Wilderness) and a viewer at the northeast corner of Black Canyon National Park.

2.0 EMISSION MODELING

Emission rates were calculated for the Bowie No. 2 Mine, the Bowie No. 1 Loadout, and coal trucks traveling between the Bowie No. 2 Mine and the Bowie No. 1 Loadout, the Oxbow mining operations near Somerset, the West Elk Mine, and the Union Pacific Railroad. Neither the West Elk operations nor the Union Pacific Railroad operations are governed by the BLM and Forest Service decisions regarding the Iron Point and Elk Creek coal lease applications; however, the emissions from the West Elk Mine and the coal trains are considered as "cumulative impacts" in accordance with the guidelines of the National Environmental Policy Act (NEPA). Emissions from all of the regional coal operations were calculated for the following two scenarios:

- The year 1998 which represents the start of the NEPA process for the coal leases; and,
- The proposed actions of both Bowie and Oxbow, including cumulative impacts from the West Elk Mine.

The coal production rates used for this air quality impact assessment are set forth in *Table M-1, Coal Production Rates.*

The air quality impacts at the Class I areas were evaluated for emission increases instead of absolute value emission rates. The emission increase scenario considered is as follows:

Proposed Actions Minus Year 1998. This scenario includes the direct emission increases at Oxbow and Bowie, plus cumulative impact emission increases that are expected to occur at the West Elk Mine.

Table M-1 Coal Production Rates		
Facility	**Year 1998 Baseline (mm tons/year)**	**Proposed Action (mm tons/year)**
Bowie Resources	1.2	5.0
Oxbow Mining	1.5	4.8
West Elk Mine	5.9	8.2
Regional Total	**8.6**	**18.0**

The Bowie and Oxbow operations are assumed to expand coal production to the levels shown in *Table M-1, Coal Production Rates*, regardless whether the coal leases are issued. Therefore, coal production under a "No-Action" alternative would be the same as for any of the "Action" alternatives analyzed in the EIS.

2.1 Fugitive Dust Emissions

The estimated fugitive dust impacts at each mine for each emission scenario are listed in *Table M-2, Summary of PM_{10} Emissions From Regional Mines*. For this analyses, it was assumed that the mines would emit up to the allowable limits that are specified in their respective air quality permits. For each mine, a PM_{10} emission factor for fugitive dust (expressed as pounds of fugitive PM_{10} per ton of mined coal) was developed by dividing their permitted allowable annual PM_{10} emissions by their allowable coal production rates. The calculated PM_{10} emission rates therefore represent "potential to emit" from each mine.

Table M-2 Summary of PM_{10} Emissions From Regional Mines			
Facility	**Air Permitted Tonnage (mm tons/year)**	**PM_{10} Emission Factor (lbs/ton of coal)**	**Annual PM_{10} Emissions (tons)**
Year 1998 Emissions			
Bowie No. 2 Mine	1.2	0.059	35.4
Bowie No. 1 Loadout	1.2	0.00152	0.9
Oxbow	1.5	0.0259	19.4
Mountain Coal	5.9	0.0251	75.8
Regional Total	8.6	--	131.5
Proposed Actions Including Cumulative Impacts by Mountain Coal			
Bowie No. 2 Mine	5	0.059	147.5
Bowie No. 1 Loadout	5	0.00152	3.8
Oxbow	4.8	0.0259	62.2
Mountain Coal	8.2	0.0257	105.4
Regional Total	18.0	--	318.9
Emission Factor Sources Bowie Resources: Allowable emission rates from most recent air quality permits. Oxbow Mining: Allowable emission rates from most recent air quality permits. Mountain Coal: Emission factor from 1996 ISC3 modeling completed by Colorado APCD.			

2.2 Tailpipe Emissions From Mining Equipment, Haul Trucks, and Locomotives

Emissions of PM_{10}, nitrogen oxides (NO_x) and sulfur dioxide (SO_2) from the mining equipment, haul trucks, and locomotives are itemized in *Table M-3, Tailpipe Emissions for Year 1998 Including Cumulative Impact*, and *Table M-4, Tailpipe Emissions for Proposed Action Including Cumulative Impact.*

In-Mine Diesel Equipment and Above-Ground Diesel Equipment. An inventory of the diesel equipment that is expected to be operated underground at the Bowie No. 2 Mine at the 5 million tons/year production rate was provided by Bowie. The annual diesel equipment utilization (expressed as horsepower-hours per year) for underground equipment at each mine was assumed to be proportional to the annual coal production. Representative emission factors for PM_{10}, NO_x, and SO_2 were obtained from Caterpillar Corporation.

Coal Trucks Between Bowie No. 2 Mine and Bowie No. 1 Loadout. The number of round trips required for Bowie was estimated by assuming each coal truck carries a payload of 28 tons. Representative tailpipe emission factors for heavy highway trucks were derived from EPA's MOBILE4 database. Fugitive dust emission factors for trucks traveling on public highways were derived from EPA's AP-42.

Locomotive Emissions. Train traffic to each mine was estimated assuming each train carries a payload of 10,000 tons. It was assumed that each train uses two locomotives, each operating at a load of 2,000 horsepower. Locomotive emissions were derived from EPA emission factors developed to support the new federal emission standards for non-road engines (EPA, 1997). The regulation requires retrofitting of locomotives, after their next normal operating cycle (about 750,000 hours of operation). EPA estimates that, on a nationwide average, the NO_x emissions from locomotives in the year 2010 would decrease by about 40 percent compared to their current levels. For this analysis, EPA's published emission factors for the year 1999 were used to estimate the year 1998 baseline emissions from locomotives, and EPA's emission factors for the retrofitted locomotives were used to estimate emissions for the No-Action and Proposed Actions (EPA, 1997).

2.3 Summary of Emission Rates and Increases Used for Air Quality Modeling

The emission rates at each facility for this analysis are listed in *Table M-5, Summary of Emissions for 1998 and Proposed Action*. The table lists the emission increases for "Proposed Action Minus 1998." The emission increases at each facility were used for the air quality modeling described in Section 3.0, Modeled Visibility and Acid Deposition Impacts, of this appendix.

3.0 MODELED VISIBILITY AND ACID DEPOSITION IMPACTS

The No-Action and Action alternatives would increase emissions of particulate matter, NO_x and SO_2 from sources along the floor of the North Fork of the Gunnison River Valley. These emissions could impact the West Elk Wilderness or Black Canyon National Park. NO_x and SO_2 emissions can react inside the plume to convert to nitric acid and sulfuric acid, which can cause increases in acid deposition at the alpine regions of the wilderness area. The nitric acid and sulfuric acid can react with ammonia in the atmosphere to form "secondary particles" that can form a regional haze that impacts visibility at locations remote from the emission source. In addition, the emissions can cause a distinct plume (called "plume blight") during the first few miles downwind before the plume breaks up as it travels through rugged terrain.

Table M-3
Tailpipe Emissions for Year 1998 Including Cumulative Impact

In-Mine Diesel-Powered Vehicles

Item	Total HP	Use		Annual Usage		NOx Emission Factor g/hp-hr	PM10 Emission Factor g/hp-hr	SO2 Emission Factor g/hp-hr	Annual NOx, tons/yr	Annual PM-10, tons/yr	Annual SO2, tons/yr
Bowie Mine @ 1.2 million tons per year	5,430	4000	hrs/yr	2.2E+07	bhp-hr/yr	6.5	0.16	0.7	155	4	17
Oxbow mine @ 1.5 million tons per year	5,430	4000	hrs/yr	2.2E+07	bhp-hr/yr	6.5	0.16	0.7	155	4	17
Mt. Coal @ 5.9 million tons per year	5,430	5600	hrs/yr	3.0E+07	bhp-hr/yr	6.5	0.16	0.7	218	5	23
Regional Total									529	13	57

Bowie No. 2 Above-Ground Equipment AT Nominal 1.5 million ton per year mining rate

Item	Quant	HP	Hr/yr	HP-hr/yr
D-9 Dozer	1	405	4250	1.7E+06
D-10 Dozer		570		0.0E+00
980 Loader	1	300	7300	2.2E+06
			Total	3.9E+06

Above-Ground Diesel Equipment

Combined Bulldozers and Front-End Loaders	Annual Usage		NOx Emission Factor g/hp-hr	PM10 Emission Factor g/hp-hr	SO2 Emission Factor g/hp-hr	Annual NOx, tons/yr	Annual PM-10, tons/yr	Annual SO2, tons/yr
Bowie Mine @ 1.2 million tons per year	3,129,000	bhp-hr/yr	6.5	0.16	0.7	22	1	2
Oxbow mine @ 1.5 million tons per year	3,911,250	bhp-hr/yr	6.5	0.16	0.7	28	1	3
Mt. Coal @ 5.9 million tons per year	18,252,500	bhp-hr/yr	6.5	0.16	0.7	131	3	14
Regional Total						181	5	19

Bowie Mine Coal Haul Trucks at 1.2 Million Tons per Year Coal Production

Item	Round Trips Per Year	RT Dist.		Annual Usage		NOx Emission Factor g/vmt	PM-10 Emission Factor for Paved Road Dust g/vmt	SO2 Emission Factor g/vmt	Annual NOx, tons/yr	Annual PM-10, tons/yr	Annual SO2, tons/yr
Coal Trucks @ 28 tons per truck	42,857	8	miles	342,857	vmt per year	11.44	49.2	5.7	4.3	18.6	2.2

Coal Trains Between Mine Site and Delta (Bowie at 1.2 Million TPY; Oxbow at 1.5 Million TPY; West Elk at 7 Million TPY)

Item	No. of Annual Trips	Cycle Time		Annual Usage for Dual Locomotive at 2,000 hp Average		NOx Emission Factor g/bhp-hr	PM Emission Factor g/bhp-hr	SO2 Emission Factor g/bhp-hr	Annual NOx, tons/yr	Annual PM-10, tons/yr	Annual SO2, tons/yr
Bowie Mine Line Haul	114	3	hrs	1,371,429	bhp-hrs/yr	13.0	0.32	0.70	20	0	1
Oxbow Mine Line Haul	143	3.5	hrs	2,000,000	bhp-hrs/yr	13.0	0.32	0.70	29	1	2
West Elk Line Haul	667	4	hrs	10,666,667	bhp-hrs/yr	13.0	0.32	0.70	153	4	8
Switch Mode During Coal Loading (1,000 hp)	924	3	hrs	2,771,429	bhp-hrs/yr	13.0	0.32	0.70	40	1	2

Table M-4
Tailpipe Emissions for Proposed Action Including Cumulative Impact

In-Mine Diesel-Powered Vehicles

Item	Aggregate HP	Use		Annual Usage		NOx Emission Factor g/hp-hr	PM10 Emission Factor g/hp-hr	SO2 Emission Factor g/hp-hr	Annual NOx, tons/yr	Annual PM-10, tons/yr	Annual SO2, tons/yr
Bowie Mine @ 5 million tons per year	5,430	4000	hrs/yr	2.2E+07	bhp-hr/yr	6.5	0.16	0.7	155	4	17
Oxbow mine @ 5 million tons per year	5,430	4000	hrs/yr	2.2E+07	bhp-hr/yr	6.5	0.16	0.7	155	4	17
Mt. Coal @ 8.2 million tons per year	5,430	6560	hrs/yr	3.6E+07	bhp-hr/yr	6.5	0.16	0.7	255	6	27
Regional Total									565	14	61

Bowie No. 2 Above-Ground Equipment at Nominal 5 mm tpy

Item	Quant	HP	Hr/yr	HP-hr/yr
D-9 Dozer	0	405	0	0.0E+00
D-10 Dozer	2	570	5256	6.0E+06
980 Loader	2	300	8111	4.9E+06
			Total	10,858,507

Above-Ground Diesel Equipment

Combined Bulldozers and Front-End Loaders	Annual Usage		NOx Emission Factor g/hp-hr	PM10 Emission Factor g/hp-hr	SO2 Emission Factor g/hp-hr	Annual NOx, tons/yr	Annual PM-10, tons/yr	Annual SO2, tons/yr
Bowie Mine @ 5 million tons per year	10,858,507	bhp-hr/yr	6.5	0.16	0.7	78	2	8
Oxbow mine @ 5 million tons per year	10,864,583	bhp-hr/yr	6.5	0.16	0.7	78	2	8
Mt. Coal @ 8.2 million tons per year	21,381,500	bhp-hr/yr	6.5	0.16	0.7	153	4	16
Regional Total						309	8	32

Bowie Mine Coal Haul Trucks at 5 Million Tons per Year Coal Production

Item	Round Trips Per Year	RT Dist.		Annual Usage		NOx Emission Factor g/vmt	PM-10 Emission Factor for Paved Road Dust g/vmt	SO2 Emission Factor g/vmt	Annual NOx, tons/yr	Annual PM-10, tons/yr	Annual SO2, tons/yr
Coal Trucks @ 28 tons per truck	178,571	8	miles	1,428,571	vmt per year	11.44	49.2	5.7	18.0	77.4	9.0

EPA-Compliant Coal Trains Between Mine Site and Hotchkiss (Bowie at 5 mm Tons; Oxbow at 5 mmTons; West Elk @ 8.2 mmTons)

Item	No. of Annual Trips	Cycle Time		Annual Usage for Dual Locomotive at 2,000 hp Average		NOx Emission Factor g/bhp-hr	PM Emission Factor g/bhp-hr	SO2 Emission Factor g/bhp-hr	Annual NOx, tons/yr	Annual PM-10, tons/yr	Annual SO2, tons/yr
Bowie Mine Line Haul	476	3	hrs	5,714,286	bhp-hrs/yr	7.8	0.32	0.70	49	2	4
Oxbow Mine Line Haul	476	3.5	hrs	6,666,667	bhp-hrs/yr	7.8	0.32	0.70	58	2	5
West Elk Line Haul	781	4	hrs	12,495,238	bhp-hrs/yr	7.8	0.32	0.70	108	4	10
Switch Mode During Coal Loading (1,000 hp)	1733	3	hrs	5,200,000	bhp-hrs/yr	13.0	0.32	0.70	74	2	4

Table M-5
Summary of Emissions for 1998 and Proposed Action

Coal Production Rates (million tons per year)

Source	Year 1998	All Alt.	Action Alt.
Bowie	1.2	5	5
Oxbow	1.5	4.8	4.8
West Elk	5.9	8.2	8.2
Total	8.6	18	1.8

Emission Increases Input to Models (tons/year)

	Grand Total PM_{10}		Grand Total NO_x		Grand Total SO_2		PM_{10} Increase	NO_x Increase	SO_2 Increase
Source	Year 1998	All Alt.	Year 1998	All Alt.	Year 1998	All Alt.	All Alt. Minus Baseline	All Alt. Minus 1998 Levels	All Alt. Minus 1998 Levels
West Elk	84	115	376	442	39	46	31	66	7.2
Oxbow	24	68	190	253	21	26	44	63	5.6
Bowie No. 2	40	154	178	233	19	25	114	55	6.0
Haul Tricks	19	77	4	18	2	9	59	14	6.8
Bowie Rail Facility	1	3.8	6	21	0.3	1.1	2.9	15	0.8
Railroad 4	1.2	2.2	40	35	2.2	3.8	1.0	-5	1.6
Railroad 3	1.2	2.2	40	35	2.2	3.8	1.0	-5	1.6
Railroad 2	1.2	2.2	40	35	2.2	3.8	1.0	-5	1.6
Railroad 1	1.2	2.2	40	35	2.2	3.8	1.0	-5	1.6
Project-Related Emissions	**172.8**	**426.6**	**914.0**	**1,107.0**	**89.9**	**122.3**	**254.9**	**193.0**	**33.8**

3.1 Conceptual Pollutant Transport

Under prevailing conditions, the wind along the North Fork Valley floor blows down-valley at night and up-valley during the day, with a few periods where the wind blows across the valley.

When wind blows in its prevailing down-valley direction, emissions from the mines would be constricted within the valley until they reached the broad plane west of the town of Paonia. At that point, the emissions could mix with regional air masses. It is unclear whether the regional air mass would then blow northward toward Grand Junction, southward toward Montrose, southeasterly toward Black Canyon, or swing back in an easterly direction toward the West Elk Wilderness.

When the wind blows in its prevailing up-valley direction along the North Fork Valley, emissions from the mines would be constricted within the valley until they reached the confluence of the West Fork of the Gunnison River (northward toward McClure Pass), Anthracite Creek (eastward toward the Raggeds

Wilderness) on Snowshoe Canyon (southward toward West Elk Wilderness). It is unclear what portion of the mine emissions would blow along each of those river drainages.

When the wind blows in its non-prevailing direction southward directly across the river valley, it is uncertain how far the plumes from the mines would travel before they either break up in rugged terrain or dilute by mixing with air masses moving along intersecting drainages. Under conditions of stable air or temperature inversions, it is unclear whether the plumes from the mines could rise upward high enough to cross ridges between the mines and the West Elk Wilderness Area.

There are no simple air quality dispersion models that can accurately simulate ground-level plume dispersion in the twisting, rugged terrain found in and surrounding the North Fork Valley. Similarly, there are no available on-site wind data to indicate how the wind along the North Fork of the Gunnison River Valley splits and mixes at each of the regional drainages. Therefore, for this analysis, a screening approach was used to estimate the maximum impacts and compare them to relevant environmental criteria. As a simplifying step, it was assumed that emissions from the mine sources at the valley floor blow as straight, continuous Gaussian plumes with no enhanced dispersion caused by crossing valleys or mixing with other regional air masses. Given this simplification, the wind rose measured at the West Elk Mine in 1987 was used with three commonly-used Gaussian dispersion models (SCREEN3, ISC3 and PLUVUE) to estimate the pollutant concentrations at the wilderness areas.

3.2 Wind Data

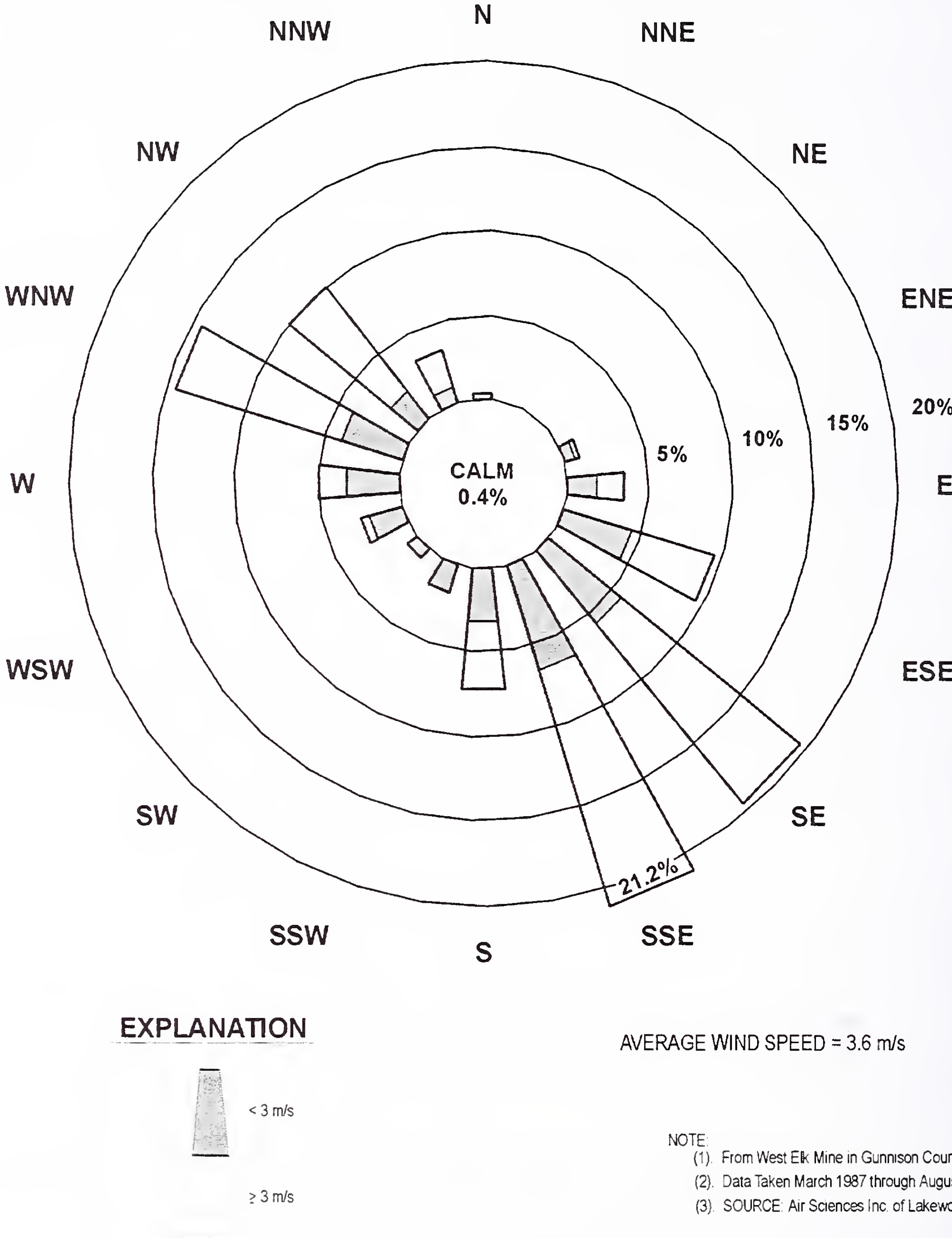
Wind speed data from the meteorological tower that was operated during spring and summer at the West Elk Mine in 1987 were used for the modeling. The wind rose shown in *Figure M-1, Wind Rose for West Elk Mine*, displays a wind pattern that is common for a narrow river valley. Strong persistent winds blow up-valley and down-valley, and weak infrequent winds blow across the valley. The prevailing winds blew up-valley or down-valley with a high wind speed (3.8 meters/second average). Cross-valley winds were infrequent (less than 10 percent frequency of occurrence) with a low speed (2.5 meters per second). The average wind speed for all directions was estimated at 3.6 meters per second.

Based on *Figure M-1, Wind Rose for the West Elk Mine*, the following values were used for the SCREEN3 modeling:

- Annual average cross-valley wind speed of 2.5 meters per second, D stability, and 5 percent per year frequency of annual occurrence for each wind sector (i.e., the wind direction was assumed to meander so each of the emission sources between Somerset and Delta impact the wilderness areas for 5 percent of the time during the year).

- 24-hour average cross-valley wind speed of 2.5 meters per second, D stability, and 25 percent frequency of occurrence from each wind sector (i.e., the wind direction was assumed to meander so each of the emission sources between Somerset and Delta would impact the wilderness areas for 6 hours during the worst-case day).

The highest emission increases would occur at the Bowie No. 2 Mine, which is located where the North Fork of the Gunnison River Valley runs in a southwest-northeast direction. Therefore, for sequential-hourly ISC3 modeling the wind rose from the West Elk Mine was rotated so the prevailing wind direction runs in a direction that is appropriate for the river valley between Paonia and Bowie (see *Figure M-2, Adjusted Wind Rose for Bowie*).



CALMS ARE WINDS WITH
SPEEDS LESS THAN 0.44 m/s
SHOWN AS DIRECTION FROM WHICH WIND IS BLOWING

AVERAGE WIND SPEED = 3.6 m/s

NOTE:
(1). From West Elk Mine in Gunnison County, Colorado
(2). Data Taken March 1987 through August 1987
(3). SOURCE: Air Sciences Inc. of Lakewood, Colorado

FIGURE M-1
WIND ROSE FOR WEST ELK MINE

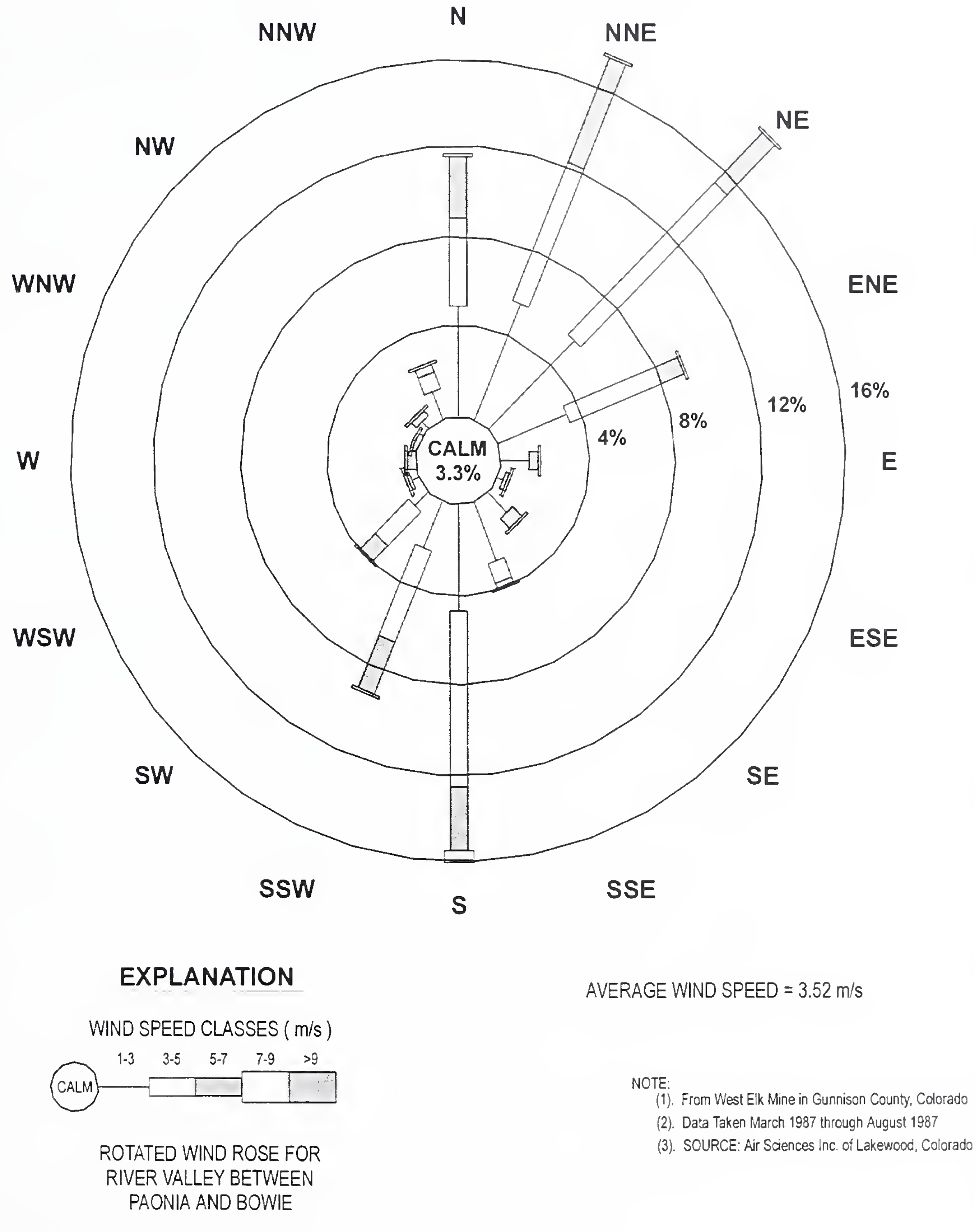


FIGURE M-2
ADJUSTED WIND ROSE FOR BOWIE

3.3 Emission Rates Used for Modeling

The visibility modeling and acid deposition assessments were completed by modeling the incremental emission increases from the 1998 air quality levels to those tonnages projected in *Table M-1, Coal Production Rates*. The modeled incremental impacts were then compared to measured baseline conditions to evaluate the significance of the modeled increases.

Table M-5, Summary of Emissions for 1998 and Proposed Action, lists the incremental emission increases as well as the estimated total regional emission rates for the year 1998 baseline and Action Alternative. As shown in *Figure 9, Emission Sources Used for Visibility and Acid Deposition Modeling*, in the separate EIS figure volume, the three mines that could impact West Elk Wilderness are spread along a serpentine 3-mile line between Paonia and Somerset, and the railroad emissions would occur along the 30-mile track between Somerset and Delta. For the computer dispersion modeling, the emission increases were apportioned between nine volume sources to represent the three mines, State Highway 133, and the railroad.

3.4 Atmospheric Conversion Rates for NO_x and SO_2

Diesel equipment at the mines emits gaseous NO_x and SO_2. Those gases must first react within the plume to form nitric acid and sulfuric acid before they can form "secondary particles" that can obscure visibility. The chemical reaction rates were evaluated as part of the regional haze assessment and "plume blight" modeling.

EPA's PLUVUE model calculates the chemical conversion rate and reports the calculated rates as part of its output report for "plume blight" impacts. The reaction rates reported by the PLUVUE model were used in the SCREEN3 modeling and ISC3 modeling to assess regional haze impacts. The reaction rates for those pollutants depend on the air temperature, amount of solar radiation, amount of ambient ozone, and the relative humidity. *Table M-6, Assumptions for Visibility and Acid Deposition Modeling*, lists the values that were assumed for the PLUVUE modeling of the reaction rates.

The PLUVUE model was used to calculate the maximum 1-hour noontime chemical reaction rates. The peak 1-hour conversion rates reported by PLUVUE were adjusted to calculate the 24-hour rates used for the regional haze modeling, using recommended nighttime conversion rates published by the Colorado Department of Public Health and Environment (CDPHE) (CDPHE, 1999). The calculated peak-hour noontime rates and the adjusted 24-hour rates are as follows:

Peak noontime NO_x conversion rate (PLUVUE)	4.5 percent/hour
Assumed nighttime NO_x conversion (CDPHE)	2.0 percent/hour
24-hour NO_x conversion rate	3.5 percent/hour
Peak noontime SO_2 conversion rate (PLUVUE)	0.7 percent/hour
Assumed nighttime SO_2 conversion (CDPHE)	0.2 percent/hour
24-hour SO_2 conversion rate	0.45 percent/hour

The fraction of NO_x and SO_2 that reacts in the plume between each emission point and receptor was calculated by multiplying the conversion rate (percent/hour) times the plume travel time (hours).

3.5 Preliminary Screening of Regional Haze Impacts

EPA's SCREEN3 model was used for a preliminary screening analysis of secondary particle formation and regional haze impact at West Elk Wilderness and Black Canyon National Park. A 5 percent increase in the 24-hour average light extinction coefficient (B-ext) at any point inside the Wilderness Area was considered a "significant impact." Therefore, the modeling receptor was placed at the

Table M-6 Assumptions for Visibility and Acid Deposition Modeling	
Assumed Background Conditions	
Background visual range at West Elk Wilderness (clearest 90th percentile)	290 km
Background visual range at Black Canyon (clearest 90th percentile)	221 km
Background ANC at South Golden Lake	114 μeq/l
"Cross-valley" wind speed for SCREEN3	2.5 m/sec
Annual-average "cross-valley" frequency of occurrence for SCREEN3	5%
Highest-day, "cross-valley" wind frequency of occurrence for SCREEN3	25% per sector
Assumed noontime ambient temperature at West Elk Wilderness	80 deg F
Assumed relative humidity on 90 percent clearest day	60%
Assumed 24-hour average ozone concentration	0.060 ppm
Atmospheric Chemical Conversion Rates	
Noontime NOx reaction rate (modeled by PLUVUE)	4.5% per hour
Noontime SO2 reaction rate (modeled by PLUVUE)	0.7% per hour
Nighttime NOx reaction rate (CDPHE guidance)	2.0% per hour
Nighttime SO2 reaction rate (CDPHE guidance)	0.2% per hour
24-hour average NOx conversion rate	3.5% per hour
24-hour average SO2 conversion rate	0.45% per hour
Modeled Criteria Pollutant Concentrations	
Annual NOx increment at South Golden Lake, Proposed Action - No-Action	0.0021 μg/m3
ScREEN3 24-hour PM10 at West Elk Wilderness, Proposed Action - Baseline	0.39 μg/m3
ISC3 highest 24-hour PM10 at West Elk Wilderness, Proposed Action - Baseline	0.89 μg/m3
ISC3 95th percentile highest 24-hour PM10 at West Elk Wilderness, Proposed Action - Baseline	0.17 μg/m3
Reduced Acid Neutralization Capacity (Significant Impact = 10%)	
Reduced ANC at South Golden Lake (Proposed Action - Year 1998 Baseline)	1.60%
Increased Extinction Coefficient (Significant Impact = 5% Increase)	
ScREEN3 increased B-ext at West Elk Wilderness, Proposed Action - No-Action	8.7%
ISC3 highest day increased B-ext at West Elk Wilderness, Proposed Action - No-Action	19.7%
ISC3 95th percentile highest day increased B-ext at West Elk Wilderness, Proposed Action	4.3%
SCREEN3 increased b-ext at Black Canyon, Proposed Action - No-Action	2.4%

northwest corner of the wilderness area (closest to the Bowie No. 2 and Oxbow mines), and the SCREEN3 modeling was completed for a 24-hour average.

Based on the assumed 90^{th} percentile, highest background visual ranges were assumed to be 290 km at West Elk Wilderness and 221 km at Black Canyon. Those background visual ranges correspond to background B-ext coefficients of 0.0135 km^{-1} at West Elk and 0.0177 km^{-1} at Black Canyon.

The modeled impacts are shown in *Table M-7, SCREEN3 B-ext Increase at Northwest Boundary of West Elk Wilderness (Proposed Action 1998)* and *Table M-8, SCREEN3 B-ext Increase at Black Canyon (Proposed Action 1998).*

The key conclusions of the SCREEN3 regional haze modeling are summarized below.

Chemical Conversion of NO_x and SO_2. Due to the low chemical conversion rates and the relatively short travel times between the mines and the receptors, relatively little of the gaseous NO_x and SO_2 are calculated to convert to secondary particles (ammonium nitrate and ammonium sulfate. The overall NO_x conversion at Black Canyon was only 9.25 percent. The overall SO_2 conversion at West Elk Wilderness was only 0.8 percent, and the overall SO_2 conversion at Black Canyon was only 1.2 percent.

Primary Plus Secondary PM_{10} Impacts Caused by Emission Increases. SCREEN3 indicated the emission increases at the mines would cause a small increase in the PM_{10} concentration (primary fugitive dust plus secondary particles) at West Elk Wilderness and Black Canyon. The calculated increase in the 24-hour average PM_{10} at West Elk is 0.39 μg/m3 for the "Proposed Action Minus Baseline." The PM_{10} increase at Black Canyon is 0.14 μg/m3 for "Proposed Action Minus Baseline."

Potentially Significant B-ext Increase at West Elk. The SCREEN3 analysis indicated a potentially significant increase in B-ext at the northwest corner of West Elk Wilderness. The modeled increase in B-ext is 8.7 percent for "Proposed Action Minus Baseline." The modeled B-ext increase for "Proposed Action Minus Baseline" exceeds the Forest Service significance threshold of 5 percent. Therefore, the "Proposed Action Minus Baseline" scenario was re-evaluated using actual meteorological data and the ISC3 maximum 24-hour B-ext impact. See Section 3.6, Detailed ISC3 Modeling of Regional Haze at West Elk Wilderness.

No Significant B-ext Impact at Black Canyon National Park. The SCREEN3 model indicated a maximum 24-hour B-ext increase of 2.4 percent, which is less than the Forest Service significance threshold of 5 percent. Therefore, the emission increases for the Proposed Action (including cumulative impacts from the West Elk Mine) would not cause significant increases in PM_{10} or B-ext at the closest National Park boundary.

3.6 Detailed ISC3 Modeling of Regional Haze at West Elk Wilderness

The preliminary screening analysis of regional haze impacts showed a potentially significant increase in the B-ext light extinction coefficient at the northwest corner of West Elk Wilderness. However, the SCCREEN3 model used for that analysis provided no information on the frequency of occurrence or the spatial extent of the modeled impact. Therefore, the regional haze impact assessment was repeated using EPA's ISC3 model and the sequential-hourly wind data that were measured in 1987 at the West Elk Mine.

Table M-7
SCREEN3 B-ext Increase at Northwest Boundary of West Elk Wilderness (Proposed Action 1998)
(Wind Speed: 2.5 m/sec and D stability based on local "cross-valley" wind data)

NOx-NO3 Conversion 3.5% Per Hour SCREEN3 24-hr Factor 0.25

Source	distance (m)	2.5 mps Plume Travel time (hrs)	1-Hr SCREEN3 X/Q (ug/m3/g/sec)	Increased NOx Emissions, Proposed Project - No Action, (tpy)	NOx Emiss. (g/s)	SCREEN3 1-hr NOx conc. (ug/m^3)	SCREEN3 24-hour NOx conc. (ug/m^3)	Fractional Conversion at ___% Per Hour Rate	Acid Gas Available for Deposition (ug/m3)
West Elk Mine	16500	1.8	0.2003	66	1.91	0.3830	0.0957	0.0632	0.00605
Oxbow Mine	16500	1.8	0.2003	63	1.81	0.3616	0.0904	0.0632	0.00572
Bowie No. 2 Mine	17600	2.0	0.193	55	1.59	0.3075	0.0769	0.0673	0.00517
haul trucks	17000	1.9	0.197	14	0.39	0.0776	0.0194	0.0651	0.00126
Bowie Rail Facility	15300	1.7	0.209	15	0.44	0.0911	0.0228	0.0588	0.00134
RR line4	16500	1.8	0.2003	-5	-0.15	-0.0302	-0.0076	0.0632	-0.00048
RR line3	15900	1.8	0.2047	-5	-0.15	-0.0309	-0.0077	0.0610	-0.00047
RR line2	24700	2.7	0.1596	-5	-0.15	-0.0241	-0.0060	0.0931	-0.00056
RR line1	44700	5.0	0.1162	-5	-0.15	-0.0175	-0.0044	0.1622	-0.00071
NO2 Available for Particulate Formation				192		1.118	0.280		0.0173
Molar Ratio, Ammonium Nitrate to NO2									1.74
Ammonium Nitrate Conc., ug/m3									0.030

SO2-SO3 Conversion 0.45% Per Hour SCREEN3 24-hr Factor 0.25

Source	distance (m)	2.5 mps Plume Travel time (hrs)	1-Hr SCREEN3 X/Q (ug/m3/g/sec)	Increased SO2 Emissions, Proposed Project - No Action, (tpy)	SO2 Emiss. (g/s)	SCREEN3 1-hr SO2 conc. (ug/m^3)	SCREEN3 24-Hr SO2 conc. (ug/m^3)	Fractional Conversion at ___% Per Hour Rate	Acid Gas Available for Particles (ug/m3)
West Elk Mine	16500	1.8	0.2003	7.20	0.21	0.0415	0.0104	0.0082	0.00009
Oxbow Mine	16500	1.8	0.2003	5.58	0.16	0.0322	0.0080	0.0082	0.00007
Bowie No. 2 Mine	17600	2.0	0.193	5.96	0.17	0.0331	0.0083	0.0088	0.00007
haul trucks	17000	1.9	0.197	6.82	0.20	0.0387	0.0097	0.0085	0.00008
Bowie Rail Facility	15300	1.7	0.209	0.78	0.02	0.0047	0.0012	0.0076	0.00001
RR line4	16500	1.8	0.2003	1.62	0.05	0.0093	0.0023	0.0082	0.00002
RR line3	15900	1.8	0.2047	1.62	0.05	0.0096	0.0024	0.0079	0.00002
RR line2	24700	2.7	0.1596	1.62	0.05	0.0074	0.0019	0.0123	0.00002
RR line1	44700	5.0	0.1162	1.62	0.05	0.0054	0.0014	0.0222	0.00003
SO3 Available for Particulate Formation				33		0.182	0.0455		0.00041
Molar Ratio, Ammonium Sulfate to SO2									2.06
Assumed Rel. humidity									0.60
Humidity Correction Factor for Ammonium sulfate									1.70
Ammonium Sulfate Conc., ug/m3									0.00142

Primary PM10 Conv. 100.0% Per Hour SCREEN3 24-hr Factor 0.25

Source	distance (m)	2.5 mps Plume Travel time (hrs)	1-Hr SCREEN3 X/Q (ug/m3/g/sec)	Increased PM-10 Emissions, Proposed Project - No Action, (tpy)	PM-10 Emiss. (g/s)	SCREEN3 1-hr PM-10 conc. (ug/m^3)	SCREEN3 24-Hr PM-10 conc. (ug/m^3)	Fractional Conversion at ___% Per Hour Rate	Primary Particles (ug/m3)
West Elk Mine	16500	1.8	0.2003	31	0.89	0.1789	0.0447	1.0000	0.04473
Oxbow Mine	16500	1.8	0.2003	44	1.27	0.2535	0.0634	1.0000	0.06338
Bowie No. 2 Mine	17600	2.0	0.193	114	3.28	0.6339	0.1585	1.0000	0.15847
haul trucks	17000	1.9	0.197	59	1.69	0.3337	0.0834	1.0000	0.08342
Bowie Rail Facility	15300	1.7	0.209	3	0.08	0.0174	0.0043	1.0000	0.00434
RR line4	16500	1.8	0.2003	1	0.03	0.0055	0.0014	1.0000	0.00138
RR line3	15900	1.8	0.2047	1	0.03	0.0056	0.0014	1.0000	0.00141
RR line2	24700	2.7	0.1596	1	0.03	0.0044	0.0011	1.0000	0.00110
RR line1	44700	5.0	0.1162	1	0.03	0.0032	0.0008	1.0000	0.00080
Primary Particulate				255		1.436	0.359		0.3590

Total Particulate at Receptor

Primary PM10	0.3590	ug/m3	92%
Secondary Ammonium Nitrate	0.030	ug/m3	8%
Secondary Ammonium Sulfate	0.00142	ug/m3	0%
Total Particulate Increment	0.3906	ug/m3	100%
IWAQM-1 B-ext Conversion Factor	0.0030		
Incremental B-ext Increase	0.00117	1/km	

Chemical Conversions

NOx	6.40%
SO2	0.84%

Background Conditions

Background Visual Range	290	km
Koschmeider bext	0.0135	1/km

Percent Increase in Extinction **8.7%**

Table M-8
SCREEN3 B-ext Increase at Northwest corner of Black Canyon (Proposed Action 1998)
(Wind speed: 3.55 m/sec and D stability based on local "down-valley" wind data)

NOx-NO3 Conversion 3.5% Per Hour SCREEN3 24-hr Factor 0.25

Source	distance (m)	3.6 mps Plume Travel time (hrs)	1-Hr SCREEN3 X/Q (ug/m3/g/sec)	Increased NOx Emissions, Proposed Project - No Action, (tpy)	NOx Emiss. (g/s)	SCREEN3 1-hr NOx conc. (ug/m^3)	SCREEN3 24-hour NOx conc. (ug/m^3)	Fractional Conversion at ___% Per Hour Rate	Acid Gas Available for Deposition (ug/m3)
West Elk Mine	39500	3.0	0.0658	66	1.91	0.1258	0.0315	0.1029	0.00324
Oxbow Mine	37200	2.4	0.068	63	1.81	0.1228	0.0307	0.0820	0.00252
Bowie No. 2 Mine	36600	2.8	0.0688	55	1.59	0.1096	0.0274	0.0957	0.00262
haul trucks	34500	2.7	0.071	14	0.39	0.0280	0.0070	0.0905	0.00063
Bowie Rail Facility	31500	2.4	0.0744	15	0.44	0.0324	0.0081	0.0830	0.00067
RR line4	37200	2.9	0.068	-5	-0.15	-0.0103	-0.0026	0.0972	-0.00025
RR line3	27500	2.1	0.0802	-5	-0.15	-0.0121	-0.0030	0.0728	-0.00022
RR line2	21700	1.7	0.0925	-5	-0.15	-0.0140	-0.0035	0.0579	-0.00020
RR line1	31500	2.4	0.0744	-5	-0.15	-0.0112	-0.0028	0.0830	-0.00023
NO2 Available for Particulate Formation				192		0.371	0.093		0.0088
Molar Ratio, Ammonium Nitrate to NO2									1.74
Ammonium Nitrate Conc., ug/m3									0.015

SO2-SO3 Conversion 0.45% Per Hour SCREEN3 24-hr Factor 0.25

Source	distance (m)	3.6 mps Plume Travel time (hrs)	1-Hr SCREEN3 X/Q (ug/m3/g/sec)	Increased SO2 Emissions, Proposed Project - No Action, (tpy)	SO2 Emiss. (g/s)	SCREEN3 1-hr SO2 conc. (ug/m^3)	SCREEN3 24-Hr SO2 conc. (ug/m^3)	Fractional Conversion at ___% Per Hour Rate	Acid Gas Available for Particles (ug/m3)
West Elk Mine	39500	3.0	0.0658	7	0.21	0.0136	0.0034	0.0137	0.00005
Oxbow Mine	37200	2.4	0.068	6	0.16	0.0109	0.0027	0.0108	0.00003
Bowie No. 2 Mine	36600	2.8	0.0688	6	0.17	0.0118	0.0030	0.0127	0.00004
haul trucks	34500	2.7	0.071	7	0.20	0.0139	0.0035	0.0119	0.00004
Bowie Rail Facility	31500	2.4	0.0744	1	0.02	0.0017	0.0004	0.0109	0.00000
RR line4	37200	2.9	0.068	2	0.05	0.0032	0.0008	0.0129	0.00001
RR line3	27500	2.1	0.0802	2	0.05	0.0037	0.0009	0.0095	0.00001
RR line2	21700	1.7	0.0925	2	0.05	0.0043	0.0011	0.0075	0.00001
RR line1	31500	2.4	0.0744	2	0.05	0.0035	0.0009	0.0109	0.00001
SO3 Available for Particulate Formation				33		0.067	0.0167		0.00020
Molar Ratio, Ammonium Sulfate to SO2									2.06
Assumed Rel. humidity									0.60
Humidity Correction Factor for Ammonium sulfate									1.70
Ammonium Sulfate Conc., ug/m3									0.00069

Primary PM10 Conv. 100.0% Per Hour SCREEN3 24-hr Factor 0.25

Source	distance (m)	3.6 mps Plume Travel time (hrs)	1-Hr SCREEN3 X/Q (ug/m3/g/sec)	Increased PM-10 Emissions, Proposed Project - No Action, (tpy)	PM-10 Emiss. (g/s)	SCREEN3 1-hr PM-10 conc. (ug/m^3)	SCREEN3 24-Hr PM-10 conc. (ug/m^3)	Fractional Conversion at ___% Per Hour Rate	Primary Particles (ug/m3)
West Elk Mine	39500	3.0	0.0658	31	0.89	0.0588	0.0147	1.0000	0.01469
Oxbow Mine	37200	2.4	0.068	44	1.27	0.0861	0.0215	1.0000	0.02152
Bowie No. 2 Mine	36600	2.8	0.0688	114	3.28	0.2260	0.0565	1.0000	0.05649
haul trucks	34500	2.7	0.071	59	1.69	0.1203	0.0301	1.0000	0.03007
Bowie Rail Facility	31500	2.4	0.0744	3	0.08	0.0062	0.0015	1.0000	0.00155
RR line4	37200	2.9	0.068	1	0.03	0.0019	0.0005	1.0000	0.00047
RR line3	27500	2.1	0.0802	1	0.03	0.0022	0.0006	1.0000	0.00055
RR line2	21700	1.7	0.0925	1	0.03	0.0025	0.0006	1.0000	0.00064
RR line1	31500	2.4	0.0744	1	0.03	0.0020	0.0005	1.0000	0.00051
Primary Particulate				255		0.506	0.126		0.1265

Total Particulate at Receptor

Primary PM10	0.1265	ug/m3	89%
Secondary Ammonium Nitrate	0.015	ug/m3	11%
Secondary Ammonium Sulfate	0.00069	ug/m3	0%
Total Particulate Increment	0.1424	ug/m3	100%
IWAQM-1 B-ext Conversion Factor	0.0030		
Incremental B-ext Increase	0.00043	1/km	

Chemical Conversions

NOx	9.25%
SO2	1.23%

Background Conditions

Background Visual Range	221	km
Koschmeider bext	0.0177	1/km

Percent Increase in Extinction **2.41%**

ISC3 Model Setup. As a simplifying step, the ISC3 model was run in "flat terrain" mode using ground-level sources and ground-level receivers. This allowed the model to simulate the emissions from each source as continuous plumes that did not break up as they crossed valleys and ridges between the source and the receptors. The model was run using "Urban" surface roughness to account for rugged terrain and forest within the study area.

Emission Rates and Particle Size Distributions. The emission increases for the "Proposed Action Minus Baseline" scenario were evaluated using the ISC3 model. The nine emission sources listed in *Table M-5, Summary of Emissions for 1998 and Proposed Action*, were used. The locations of each source relative to the wilderness area and National Park are shown in *Figure 9, Emission Sources Used for Visibility and Acid Deposition Modeling*, found in the separate EIS figure volume. As a simplifying step, each source was modeled as a ground-level volume source. The model was set to deplete the downwind PM_{10} concentrations due to gravity particle settling. Each PM_{10} source was assigned an assumed particle size distribution based on the distributions that were used by the Colorado Air Pollution and Control Division (APCD) during their modeling of the fenceline PM_{10} impacts at the West Elk Mine.

Receptor Grids. Four sets of receptor grids were used: A set of 25 receptors along the northwest and northern boundaries of West Elk Wilderness; a grid spacing of 2.5 kilometers between the sources and the West Elk boundary; a grid spacing of 5 kilometers extending 50 km south of the northern boundary of West Elk Wilderness; and one single receptor placed at the northeast corner of Black Canyon National Park.

Sequential-Hourly Wind Data. One hundred sixty days of sequential-hourly wind data for the period March-August 1987 from the West Elk Mine were run. The model was run using two wind scenarios: as measured at West Elk with no adjustments; and rotated to match the orientation of the valley between Paonia and Bowie. See *Figure M-1, Wind Rose for West Elk Mine*, and *Figure M-2, Adjusted Wind Rose for Bowie*. Primary PM_{10} emissions from the nine sources were initially run to determine whether the "rotated" or "non-rated" wind data gave the highest value at West Elk Wilderness. The modeled results were as follows:

Wind Field Rotation	Maximum 24-hour Primary PM_{10}
Unrotated data from West Elk Mine	0.3 μg/m3
Rotated wind field at Bowie	0.8 μg/m3 (at far northwest corner)

The "rotated" wind field yielded the highest impacts at West Elk Wilderness. Therefore, the "rotated" wind data were used for all subsequent modeling on this project.

Frequency of Occurrence of Primary PM_{10} Impacts at West Elk. To test the conservativeness of the SCREEN3 modeling, the ISC3 model was used to calculate the PM_{10} impacts for 160 days of measured wind data for the period March-August 1987. The primary PM_{10} impacts modeled by ISC3 were then compared to the primary PM_{10} impacts modeled by SCREEN3. The frequency of occurrence of the 24-hour primary PM_{10} impacts at the northwest West Elk boundary were as follows:

Primary PM_{10} (μg/m3) at West Elk	Days Exceeded by ISC3 Model	Percentile Value
0.8 (Maximum ISC3)	Highest event	100%
0.36 (SCREEN3 Value for West Elk)	3 days out of 160	98% highest value
0.104	16 days out of 160	90% highest value

Frequency of Occurrence of Primary PM_{10} at Black Canyon. ISC3 modeled the 24-hour PM_{10} impacts for 160 days of measured wind data for the period March-August 1987. The ISC3 values were compared to the SCREEN3 value. The frequency of occurrence of the 24-hour primary PM_{10} impacts at the northeast Black Canyon boundary were as follows:

Primary PM_{10} (μg/m3) at Black Canyon	Days Exceeded by ISC3 Model	Percentile Value
0.17 (Maximum ISC3)	Highest event	100%
0.13 (SCREEN3 Value for Black Canyon)	5 days out of 160	97% highest value
0.076	16 days out of 160	90% highest value

Inferred Conservativeness of SCREEN3 Analysis. The primary PM_{10} impact calculated for the "Proposed Action Minus 1998" scenario using the SCREEN3 model in *Table M-7, SCREEN3 B-ext Increase at Northwest Boundary of West Elk Wilderness (Proposed Action 1998)*, represents the 98th percentile highest value that was modeled by ISC3 using actual wind data. Therefore, it is concluded that the SCREEN3 regional haze analysis for West Elk Wilderness provides the 98th percentile highest B-ext impact at the West Elk Wilderness boundary. The SCREEN3 regional haze assessment at Black Canyon shown in *Table M-8, SCREEN3 B-ext Increase at Northwest Corner of Black Canyon* (Proposed Action 1998), provides the 97th percentile highest B-ext impact.

Chemical Conversion of Gaseous NO_x and SO_2, to Form Secondary Particles. The ISC3 model was used to determine the maximum gaseous NO_x and SO_2 concentrations at each of the receptor points. Based on the calculated chemical conversion rates described in Section 3.4, Atmospheric Conversion Rates for NO_x and SO_2, the following conversion factors were used to calculate the ammonium nitrate and ammonium sulfate concentrations at each ISC3 receptor:

1 μg/m3 NO_x reacts to form 0.136 μg/m3 of ammonium nitrate
1 μg/m3 SO_2 reacts to form 0.037 μg/m3 of ammonium sulfate

Frequency of Occurrence of B-ext Increase Using ISC3 Model. The ISC3 model was used to calculate the 24-hour PM_{10}, NO_x, SO_2 and B-ext concentrations along the West Elk boundary for 160 days of available data. The frequency of occurrence of B-ext increases caused by the "Proposed Action Minus 1998" emission increases (assuming a 290 km background visual range) are listed below:

Percentile	Primary PM_{10}	Total PM_{10}	Increase in B-ext
Highest 24-hour (3/26/87)	0.81 μg/m3	0.98 μg/m3	19.7% increase
95th percentile day	0.17 μg/m3	0.19 μg/m3	4.3% increase
90th percentile day	0.104 μg/m3	0.114 μg/m3	2.6% increase

The highest modeled B-ext increase of 19.7 percent exceeds the Forest Service significance threshold of 5 percent, but the 95th percentile B-ext increase is below the threshold.

Spatial Distribution of B-ext Impact on Worst Day for "Proposed Action Minus 1998. The B-ext increase at the maximum receptor on the highest day exceeded the Forest Service threshold. Therefore, the ISC3 model was used to evaluate the spatial distribution of the impacts on the 3/26/87 modeling day (the day that produced the maximum impact at the wilderness boundary). *Figure M-3, Spatial Distribution of Maximum PM_{10} Increase for "Proposed Action Minus 1998"*, shows the modeled increase in PM_{10} concentration (primary plus secondary) on that day. The shaded regions of the figure show where the PM_{10} increase exceed 0.22 μg/m3 (corresponding to a B-ext increase of 5 percent

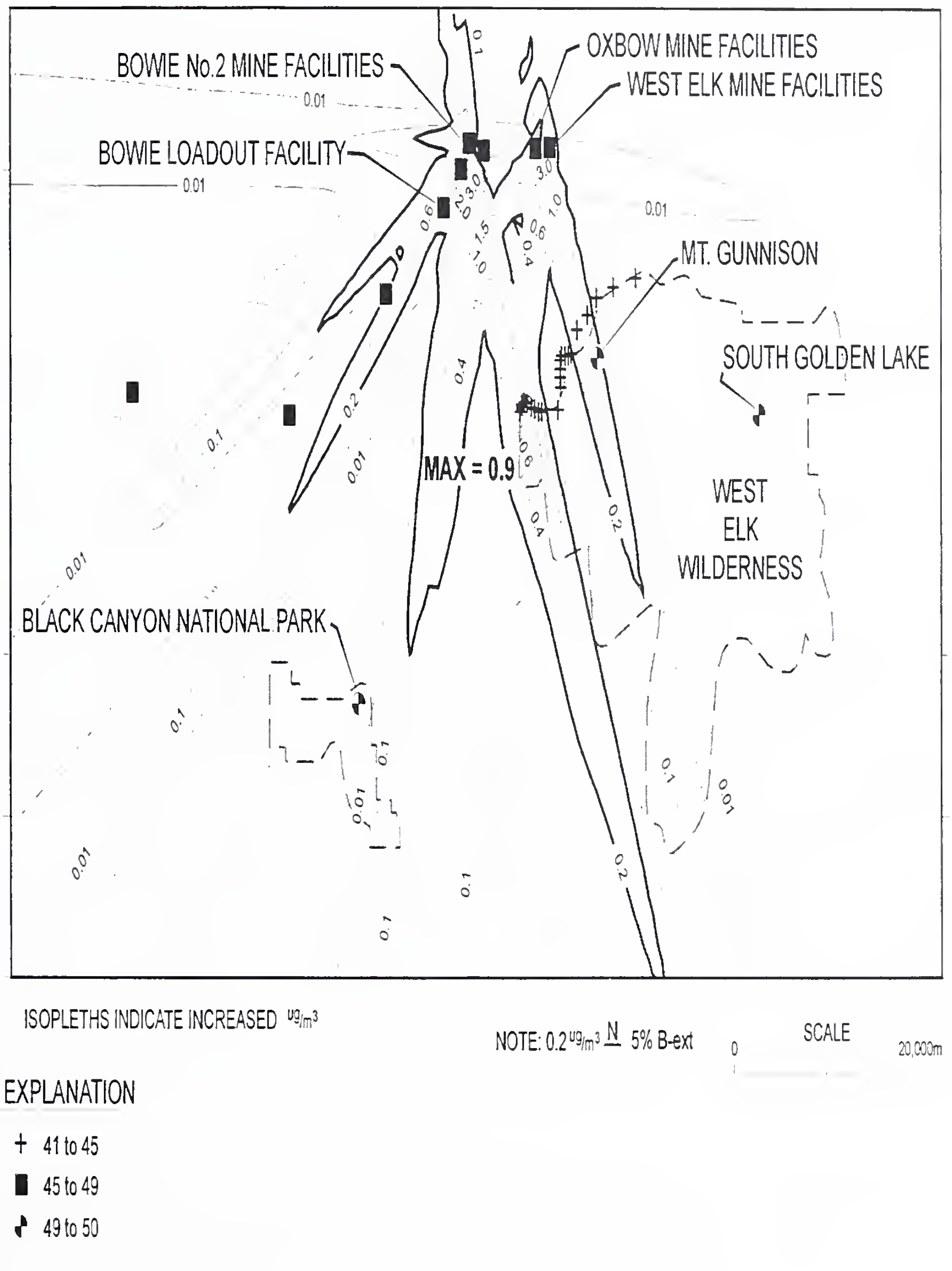


FIGURE M-3

SPATIAL DISTRIBUTION OF MAXIMUM PM_{10} INCREASE FOR "PROPOSED ACTION MINUS 1998"

based on a 290 km background visual range). As shown in *Figure M-3, Spatial Distribution of Maximum PM_{10} Increase for "Proposed Action Minus 1998"*, the unacceptable B-ext impact is limited to two relatively small areas at the northwest corner of West Elk Wilderness.

3.7 Detailed ISC3 Modeling of Acid Deposition at West Elk Wilderness Area

Impacts from acid deposition at alpine lakes were evaluated using the screening procedure developed by the Forest Service (Fox et. Al., 1983). Calculations are shown on *Table M-9, ISC3 Annual ANC Change at South Golden Lake (Action Alternative-1998).* The modeled decrease in the acid neutralization capacity (ANC) at South Golden Lake was less than the Forest Service criterion defining a "significant impact." The steps for the acid deposition assessment were as follows:

1. Emission increases for the "Proposed Action Minus Baseline" scenario were used to account for expected production increases at the West Elk Mine.

2. The annual average NO_x and SO_2 concentrations were modeled by the ISC3 model using the "rotated" wind data applicable for the North Fork Valley near the Bowie No. 2 Mine. The 160 days of wind data for the period March - August 1987 were available for the modeling. It was assumed the annual average was represented by the average of the 160 days of available data. The modeled annual average concentrations at South Golden Lake were as follows:

   Annual NO_x = 0.000205 μg/m3
   Annual SO_2 = 0.00008 μg/m3

3. The "dry deposition rates" for NO_x and SO_2 were estimated using deposition velocities of 0.007 m/sec and 0.024 m/sec, respectively based on the published guidelines.

4. The total deposition of nitrogen and sulfur were estimated by assuming that the total deposition is twice the dry deposition.

5. The year 1998 alkalinity of South Golden Lake was assumed to be 114 microequivalents per liter (μeq/l) based on information from the Forest Service.

6. Annual average precipitation at South Golden Lake was assumed to be 40 inches based on information from the Forest Service.

The modeled decrease in the ANC at South Golden Lake is 1.6 percent. The Forest Service considers a decrease in the ANC of 10 percent to constitute a significant impact. The modeled impact is below the criterion.

3.8 PLUVUE Modeling of Localized Plume Blight Downwind of Bowie No. 2 Mine

Of the mines evaluated for this analysis, only the Bowie No. 2 surface operations can be seen from West Elk Wilderness. An observer on top of Mt. Gunnison at the northwest corner of the wilderness area can look northwest over the top of Jumbo Mountain and see the mine's surface facilities. In some cases when the wind direction and the sun are aligned, an observer on Mt. Gunnison might see a distinct plume starting at the mine and extending downwind until the plume is dispersed by the rugged terrain.

Table M-9
ISC3 Annual ANC Change at South Golden Lake (Action Alternative - 1998)

Baseline Conditions at South Golden Lake	
Alkalinity	41 μeq/l
Precipitation	40 inches
Nitrogen Deposition	
Annual NOx concentration by ISC3 Model (μg/m3)	0.00205
Molar Ration R, N/NO2	0.3043
NO2 deposition velocity Vd, m/sec	0.0070
DEP (total-to-dry ratio)	2.0000
Units correction Fc	315.4000
Nitrogen Flux, kg N/ha/year	0.0028
Sulfur Deposition	
Annual SO2 concentration by ISC3 Model (μg/m3)	0.00008
Molar Ratio R, S/SO2	0.5000
SO2 deposition velocity Vd, m/sec	0.0240
DEP (total-to-dry ratio)	2.000
Units correction Fc	315.4000
Sulfur Flux, kg s/ha/year	0.0006
Unit Conversions	
Alkalinity	0.00141 eq/l
Precipitation	1.02 meters
N Flux Dn	0.00275 kg/ha/yr
S Flux Ds	0.00061 kg/ha/yr
Rn Factor (N/NO2)	0.30
Rs Factor (S/SO2)	0.5
Nitrogen Eq. Flux Hn	0.0000197 eq/m2
Sulfur Equ. Flux Hs	0.00000378 eq/m2

Basis: D.G. Fox, 1983, "A Suggested methodology for an Acid Deposition Screening Technique Applicable Within 200 km of Isolated Sources", Preliminary Draft, 1983.

Equations:
Total Flux (kg/ha/yr = (Conc.) X Vd x R x DEP x Fc
Hn = Dn/(10 x Rn x 46)
Hs = Ds/(10 x Rs x 32)
Delta ANC (%) = 100 * [(Hs+Hn)/d/1000/A]

	Delta ANC **1.6%**

The visual impact caused by a distinct plume emitted from a distinct source is called "plume blight." Plume blight is different from regional haze where the viewer can perceive visibility degradation in all directions but the location of the emission source cannot be identified. The plume blight impact in this example would probably be limited to the section of plume immediately downwind of the Bowie No. 2 Mine. If the wind was blowing in a direction other than along the North Fork Valley, it is expected that the distinct plume would remain intact for only a few miles before it dispersed over mountainous terrain.

EPA's PLUVUE visibility model was used to evaluate plume blight for this viewing condition. PLUVUE is a relatively simple screening tool because it uses Gaussian dispersion modeling of emissions from the source to the viewer based on a single wind speed and direction. PLUVUE models the downwind conversion of gaseous NO_x and SO_2 to form secondary particles (ammonium nitrate and ammonium sulfate) which contribute to visibility impairment. PLUVUE allows the user to independently select the following source viewer parameters:

- Orientation of the viewer relative to the emission source.

- Wind speed and wind direction relative to the source and the viewer.
- Date and time, which fix the sun direction and sun height relative to the source and the viewer. For a given viewing angle, this allows the user to assess the impacts that would occur at different times of the day. For example, assume the viewer was looking westward at an important vista. Using PLUVUE the user could place the sun along the eastern horizon to simulate early morning conditions with the sun behind the viewer, or the user could place the sun along the western horizon to simulate late afternoon conditions with the sun in front of the viewer. Those two conditions are generally the most restrictive for visibility impairment. The most severe condition is when the viewer is looking in the direction of the emission source with the sun behind the source (in front of the viewer).

For each selected modeling condition, PLUVUE quantifies the following visibility parameters:

Plume Contrast. Contrast is the difference in brightness between the plume and the background surfaced behind the plume. The perceived contrast depends on the color of the background surface (e.g., a dark background surface such as a forested hillside) as opposed to a light background (e.g., a light surface) such as the sky. EPA defines "significant impact" as a plume contrast exceeding 0.05.

Plume Perceptibility Parameter E(L*a*b*). This is a parameter that quantifies the perception of a plume based on changes in visual qualities described as brightness (L*), color saturation (b*), and color changes (a*). EPA defines "significant impact" as a modeled E(L*a*b) exceeding 2.0.

The emissions from the Bowie No. 2 surface operation for the "Proposed Action" were evaluated based on the following assumptions:

Viewer Locations. As shown in *Figure 10, Emission Sources and Viewers for PLUVUE Modeling*, set forth in the separate EIS figure volume, one viewer was placed on top of Mt. Gunnison at the northwest corner of the West Elk Wilderness and a second viewer was placed at the northeast corner of Black Canyon National Park.

Emissions From Bowie No. 2 Mine. PLUVUE can model only a single emission source. The Bowie No. 2 Mine was selected as the representative source because it is the only facility that is visible from West Elk Wilderness. The following "Proposed Action" emission rates were used:

- 154 tons/year of PM_{10}

- 233 tons/year of NO_x
- 24 tons/year of SO_2

Wind Direction. EPA's original visibility modeling protocol (EPA, 1988) specifies a worst-case wind direction that is 11.5 degrees away from the line connecting the source and the viewer.

The resulting wind directions for the two viewers are shown in *Figure 10, Emission Sources and Viewers for PLUVUE Modeling*, set forth in the separate EIS figure volume. Note that these wind directions represent a worst-case condition, and they are not the prevailing wind directions.

Wind Speed and Atmospheric Stability. EPA guidance specifies that the visibility impact assessment should be completed using the 99th percentile worst-case wind speed and stability class. The ISC3 model was used to identify the 99th percentile worst-case condition for each viewer. Because the two viewers are both about 3 hours "downwind" of the Bowie No. 2 Mine, ISC3 was run to identify the 3-hour periods that caused the highest 3-hour average concentrations. The specified conditions for the two viewer locations were as follows:

Viewer	Average Wind Condition During Highest 3-Hour Period
Mt. Gunnison	1.5 meters/second and E stability
Black Canyon	3.9 meters/second and D stability

Viewing Angles. This assessment focused on plume blight within the first few miles of plume travel. Viewing angles ranging from directly at the mine source to cross-plume were considered. Viewing angles looking downwind at points more than 15 km from the Bowie No. 2 Mine were not considered because it is unreasonable to assume that the emissions would form a uniform, intact "plume" beyond 15 km downwind of the mine.

Date and Time to Specify Sun Angle. Sun angles corresponding to July 4 were assumed. Three separate sun angles were run for each vista: 1 hour after sunrise with the sun near the northeast horizon; mid-day with the sun nearly overhead; and 1 hour before sunset with the sun near the northwest horizon.

Background Visual Range. The modeling assumes a clear, warm day with low background pollutant concentrations. The 90th percentile background visual range at West Elk Wilderness is 290 km, and the 90th percentile background at Black Canyon is 221 km.

The results of the PLUVUE modeling for each viewer are listed in *Table M-10, PLUVUE Modeling Results*. EPA's significant impact is defined as E(L*a*b*) exceeding 2.0 or Contrast exceeding 0.05. The results were as follows.

- The highest impacts occur when the Mt. Gunnison viewer looks upwind in a northwest direction toward the Bowie No. 2 Mine at sunset, when the sun is almost directly behind the mine. Under that condition, both the modeled E(L*a*b*) and Contrast exceed EPA's criteria. The modeled impacts for the other viewing angles and/or sun angles were below EPA's criteria.

- The highest impacts for the Black Canyon viewer are less than EPA's criteria. The highest modeling result occurs when the viewer looks eastward (cross-plume) at sunset.

Table M-10
PLUVUE Modeling Results

Mt. Gunnison Viewer (1.5 meter/second wind speed and E stability)

	1 hour after sunrise		Noon		1 hour before sunset	
Viewing Direction	**E(L*a*b*)**	**Contrast**	**E(L*a*b*)**	**Contrast**	**E(L*a*b*)**	**Contrast**
N.W., almost directly toward mine	0.67	0.012	0.78	0.035	4.90	0.11
Cross-plume, WSW Toward Delta	0.37	0.002	0.094	0.002	0.54	0.007

Black Canyon Observer (3.9 meters/second wind speed and D stability)

	1 hour after sunrise		Noon		1 hour before sunset	
Viewing Direction	**E(L*a*b*)**	**Contrast**	**E(L*a*b*)**	**Contrast**	**E(L*a*b*)**	**Contrast**
N.E., almost directly toward mine	0.58	0.005	0.26	0.009	1.7	0.041
Cross-plume, ENE toward West Elk Wilderness	1.1	0.004	0.09	0.001	0.48	0.002

Emissions:	Proposed-Action emissions from Bowie No. 2 mine	
	NOX	233 tpy
	PM	154 tpy
	SO2	24 tpy

Impact Thresholds
E(L*a*b*): significant impact at 2.0
Contrast: significant impact at 0.05

4.0 UNCERTAINTY IN MODELING METHODS AND ASSUMPTIONS

The impact analysis completed for this analysis was intended to provide a reasonably "worst case" evaluation of the impacts at West Elk Wilderness and Black Canyon National Park. Some of the methodologies and assumptions used might have contributed to conservatively high modeling results. The key assumptions are described below.

Use of "Flat Terrain" Dispersion Models. All of the dispersion models (SCREEN3, ISC3 and PLUVUE) assume continuous Gaussian dispersion as the plume travels in a straight line between the source and receptor. That assumption is appropriate in flat terrain, but it probably over-predicts the downwind impacts in rugged terrain. Those models cannot account for enhanced dispersion that would occur if the emission plume climbed over ridgetops or crossed a valley. Those models cannot account for enhanced dispersion that would be expected if the emission plumes intersected valley winds in other drainages and mixed with regional air masses.

Modeling of Potential to Emit vs. Actual Emissions. PM_{10} emissions from fugitive dust are the largest contributor to visibility impacts and "plume blight" at West Elk Wilderness. For this assessment, each mine was assumed to simultaneously emit fugitive dust at their respective permit limits. It is unlikely that each mine would simultaneously emit at such high rates.

Simultaneous Worst Case Wind Condition and Cleanest Background Condition. The SCREEN3 and ISC3 models predicted the downwind impacts for the worst case day (97th to 100th percentile), and compared them to a background visual range based on the 90th percentile cleanest day. On a

statistical basis, simultaneous occurrence of those 97^{th} percentile and 90^{th} percentile conditions would occur only about 0.3 percent of the time, or about 1 day per year.

Meteorological Data. All air quality modeling analyses rely on meteorological data. For the modeling analyses conducted here, only a limited (6 months) set of site specific (influenced by up and down-valley winds) meteorological data existed at the time of the analysis. This data was used because it was the best available at the time, and has been used by the CDPHE in the past. The CDPHE has expressed concerns that the deficiencies in the available meteorological data will increase modeling uncertainties. Therefore a proposed mitigation to collect additional (1 year from a site specified by CDPHE) meteorological data is listed in this document.

Appendix N

Noise

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1.0 INTRODUCTION

Environmental noise is typically measured in A-weighted decibels (dBA). The A-weight is automatically completed by noise meters and is a frequency-dependent sound level adjustment that simulates the sensitivity of human hearing at various sound frequencies. See *Figure 25, Noise Levels Caused by Typical Activities*, in the EIS figure volume; this figure shows the noise levels generated by familiar operations.

The dBA sound level scale is a logarithmic rather than a linear scale, so the dBA reading is not directly related to the actual energy of the sound. The smallest clearly discernible noise level increase is about 3 dBA, which corresponds to a doubling of the sound energy. A 10 dBA noise increase is perceived as a doubling of the judged loudness. For example, one bulldozer typically generates a sound level of about 80 dBA at a distance of 50 feet. Two bulldozers side-by-side would give a noise reading of 83 dBA, and would be perceived as barely louder than one bulldozer. Ten bulldozers side-by-side would give a noise reading of 90 dBA, and would be perceived as twice as loud as one single bulldozer.

The environmental impact of a given noise level depends partially on the noise duration. The following noise level descriptions are used for this analysis to assess noise impacts.

- 24-hour Equivalent Noise Level L-eq. During any given period, the instantaneous noise level usually fluctuates. The L-eq is the single noise level that equates to the average sound energy during the averaging period. The L-eq is the noise descriptor that is used in the Colorado state noise regulation, as well as being used by the Federal Highway Administration to evaluate traffic noise.

- 24-hour Day-Night Noise Level L-dn. The L-dn is the weighted average of the individual hourly L-eq values during a 24-hour day, adjusted by adding a 10 dBA factor to the L-eq readings during nighttime hours (10:00 p.m. to 7:00 a.m.) to account for the fact that noise is more annoying at night. The L-dn is used by the Federal Transit Administration to evaluate highway noise and railroad noise.

- Maximum Sound Level L-max. The L-max is the loudest 1-second sound level during any specified period. It is automatically recorded by some noise monitors. Otherwise it is interpreted to be the maximum value that is observed on the electronic readout of the noise monitor while the monitor is set on “slow” response. The L-max is the noise descriptor that is regulated by the Colorado noise statute.

- Percentile Noise Level L-n. The L-n is the noise level that is exceeded “n percent” of the time during the measurement period. For example, a measured L-25 of 60 dBA indicates that the noise was louder than 60 dBA for 25 percent of the measurement period. Some states (other than Colorado) regulate community noise based on the L-n.

2.0 NOISE REGULATIONS AND GUIDELINES

2.1 Colorado Noise Emission Limits

The state of Colorado has noise regulations that specify allowable daytime and nighttime noise limits (Colorado Regulation 25-12 Article 12, “Noise Abatement”). The Colorado noise regulations differ significantly from most state and local noise regulations typically found in the United States. Most noise regulations typically limit the noise levels at the receiving property (e.g., 50 dBA allowable daytime noise level at the property line of a residence). However, the Colorado noise regulations restrict noise emissions radiating from an industrial facility, regardless of how far it is to the closest

receiving residential property. The following noise emission limits apply at a point 25 feet from any industrial facility's property line:

- Daytime L-max 90 dBA
- Nighttime 75 dBA

The Colorado statute does not apply to traffic traveling along public highways. However, the regulation does apply to railroads, with the railroad right-of-way specifying the "facility boundary." Unlike most states, the Colorado statute does not exempt safety alarms.

2.2 Noise Guidelines for Federally-Funded Transit Projects (Highways and Railroads)

The Dederal Department of Transportation and its sub-agency, the Federal Transit Administration (FTA) have established non-binding guidelines to define unacceptable noise impacts in environmental impact statement (EIS) documents that involve federally-funded highway, railroad, and airport projects (FTA, 1995). Note that these regulations do not directly apply to trucks or coal trains associated with the coal mines for this EIS because the proposed exploration and mining activities would not receive federal funding. However, the FTA noise guidelines are presented here to describe a relevant set of criteria that can be used to qualitatively rank the noise impacts caused by increased usage of haul trucks and coal trains.

The FTA noise criteria are based on a series of historical studies that evaluated public annoyance caused by noise increases (EPA, 1974). Those studies indicated that, when the existing noise levels are low, it takes a large increase in the noise level to cause an adverse public reaction. However, when the existing noise level is already high, it requires only a small increase in the noise level to produce significant annoyance.

Based on these historical studies, The FTA developed a "sliding scale" set of criteria to define three noise descriptors: "no impact"; "impact"; and "severe impact". For residential areas, the FTA criteria are based on the 24-hour weighed-average L-dn. This is an outdoor limit that applies at the property line of the receiving property. See *Figure 26, Federal Transit Administration Noise Impact Criteria for Highway Traffic and Railroad Projects*, in the EIS figure volume; this figure shows the impact criteria.

Another noise criterion that has no legal applicability to the proposed exploration and mining activities (but which provides a relevant criterion for assessing environmental impacts) is the recommended maximum 1-hour outdoor L-eq noise level that is used by the Federal Highway Administration (FHWA, 1995). For federally-funded projects, the Federal Highway Administration requires installation of noise mitigation if a proposed highway project causes a maximum hourly outdoor noise level (L-eq(h)) exceeding 67 dBA at any residential property.

3.0 BACKGROUND NOSIE LEVELS

Background noise level measurements at representative locations around the project site were taken on April 21, 1999 and April 23, 1999. The measurements were taken using a hand-held noise monitor (Larson-Davis Model 720) that was set for A-weighting and "slow" response. The monitor has a detection range of about 25 dBA to 120 dBA. The weather conditions during the noise monitoring were cool with little wind.

Table N-1, Measured Background Noise Levels at Rural Areas Near Paonia and *Table N-2, Urban Background Noise Levels*, list the measured background values that were taken during periods when there were no mine-related trucks or trains. All of the measurements were "spot check" values taken using the hand-held meter over an averaging time of 10 seconds to 10 minutes. Rural background measurements were taken during the daytime and nighttime at two locations on Garvin Mesa and at

one location next to State Highway 133. Daytime and nighttime background noise readings were taken at several locations in Paonia and Hotchkiss. Some of the monitoring stations at Paonia and Hotckhiss were later used to measure noise levels caused by passing coal trains.

In general, the background noise measurements were as expected. The quietest measurements taken at night on Garvin Mesa were 36 dBA, with the predominant noises being natural bird sounds. Routine daytime noise levels in the urban residential areas were 48 to 56 dBA with predominant sounds produced by routine local traffic. At the rural site near State Highway 133, the spot check measurements showed 41 to 49 dBA during brief periods of no discernible traffic and spot noise levels of 64 dBA while a coal truck drove past.

Many of the noise comments received during scoping and on the draft EIS for the leasing of the Iron Pont and Elk Creek tracts in the North Fork Valley highlighted the noise impacts from trains passing through the town of Paonia and Hotchkiss. A series of noise measurements were taken near the railroad tracks in these two towns in April 1999. See *Table N-3, Measured Coal Train Noise Levels.*

Noise readings were taken at receiver locations near the railroad tracks in Paonia and Hotchkiss. The purpose of the readings was to determine the L-eq and L-max train noise at locations representing homes at varying distances from the tracks. The L-eq readings were used to calculate the 24-hour average L-dn values for input to the FTA noise assessment methodology. The L-max readings were used to assess compliance with Colorado noise methodology. The L-max readings were used to assess compliance with Colorado noise statute. Some of the receivers represented homes near the tracks, with no intervening buildings that would reduce noise levels. Other receivers represented homes in neighborhoods several blocks from the tracks, with buildings between them and the tracks.

Table N-1
Measured Background Noise Levels at Rural Areas Near Paonia

Time of Day	Condition	Noise Levels in dBA		Predominant Noises
		L-eq	L-25	
Residence at 1660 4100 Road (Closest Residence to Bowie No. 1 Rail Loadout Facility)				
4/21/99 - 16:25	Back patio; no train loading; line of sight to truck unloading silos; est. 1,500 feet away from silos	55	59	Traffic on Highway 133; fan noise from truck unloading facility
4/23/99 - 04:35	Front yard during period of no train or truck activity	35	38	Very quiet; distant highway noise
Terror Creek Winery, No Line of Sight to Highway or Train Loadout				
4/21/99 - 15:06	Daytime; no train loading; no line of sight to any industrial activity	53	61	Birds, breeze in trees
Traffic Noise From Highway 153, Taken at "Colorado Western Slope Counseling" 150 Feet From Highway				
4/21/99 - 17:18	Noise without any passing vehicles	41	46	River sounds, birds, etc.
	Cars and pickup noise	53	59	Max. noise during car passing
	Coal trucks	62	64	Max. noise during truck passage

Table N-2 Urban Background Noise Levels			
Time of Day	**Condition**	**L-eq Noise Levels in dBA**	**Predominant Noise**
Paonia Receiver P-1: Main Street; ½ Block (115 Feet) From RR Tracks			
4/22/99 - 13:16	Daytime baseline	58	Birds; distant traffic
4/23/99 - 04:10	Nighttime baseline	36	Distant exhaust fan; distant creek
Paonia Receiver P-2: 118 Main Street; 1 ½ Block (490 Feet) From RR Tracks			
4/22/99 - 13:10	Daytime baseline	48	Birds; distant traffic; distant carpentry
4/23/99 - 04:00	Nighttime baseline	41	Distant exhaust fan; distant creek
Paonia Receiver P-3: 224 Main Street; 2 ½ Blocks (9900 Feet) From RR Tracks			
4/22/99 - 13:03	Daytime baseline	51	Birds; distant traffic
4/23/99 - 04:15	Nighttime baseline	40	Distant drainage ditch; distant exhaust fan
Hotchkiss Receiver H-2: 4th Street and High Street; 1 Block (240 Feet) From RR Tracks			
4/22/99 - 12:25	Daytime baseline	48	Distant traffic, birds, distant carpentry
4/23/99 - 03:30	Nighttime baseline	36	Distant creek, distant traffic
Hotchkiss Receiver H-3: 4th Street and Orchard Street; 2 Blocks (550 Feet) From RR Tracks			
4/22/99 - 12:28	Daytime baseline	50	Distant traffic, birds, distant dog
4/23/99 - 03:30	Nighttime baseline	35	Distant drainage ditch, distant traffic

The noise measurement locations and summaries of the measured noise levels are shown on the following figures found in the EIS figure volume:

- *Figure 27, Train Noise at Paonia (4/21/99)*;
- *Figure 28, Train Noise at Paonia (4/23/99)*; and,
- *Figure 29, Train Noise at Hotchkiss (4/21/99 and 4/23/99).*

All of the noise measurements were taken with a hand-held noise monitor (Larson-Davis Model 72). The monitors were set on "slow" response in accordance with FTA guidance for community noise surveys. Each monitor was calibrated using a factory-supplied calibrator before and after each measurement. The weather was well suited for noise measurements; cool weather, no significant precipitation, and calm winds that did not cause discernible noise in the trees.

4.0 ENVIRONMENTAL CONSEQUENCES

Noise has historically been recognized as a health hazard with the potential for causing hearing damage. Efforts by industry and regulatory actions have lessened the likelihood for hearing damage occurrence. For example, the U.S. Mine Safety and Health Administration (MSHA) imposes noise standards on coal mining operations for worker hearing protection.

A secondary impact associated with noise is the nuisance effect. The nuisance effects of noise include interference with speech, physiologically unsettling environment at home and work, and more specific problems such as a disruption of sleep. The extent of these effects varies, sometimes significantly, between individuals and as a factor of the noise source.

Table N-3 Measured Coal Train Noise Levels					
Location	**Orientation to Tracks**	**Daytime Baseline Noise Level Without Trains (dBA)**	**Nighttime Baseline Noise Level Without Trains (dBA)**	**Noise Level During Passing Coal Train (dBA, L-eq for 3-5 minutes)**	**L-Max of Passing Coal Train (dBA)**
P-1 (Paonia) Residence near 1st & Main, outdoors	115 ft. from tracks; partially shielded by neighboring houses	56	36	61 (westbound)	68
P-2 (Paonia) Residence, 118 Main Street	490 ft from tracks, mostly shielded by neighboring houses	48	41	57 (westbound)	65
P-3 (Paonia) Residence, 224 Main Street	800 ft from tracks, entirely shielded by neighboring houses	51	40	56 (westbound)	66
P-4 (Paonia) Non-residential Location on Sidewalk on 2nd Street	30 ft. from tracks, with unobstructed exposure to train nosie	56	36	100 (eastbound)	110 (nearby horn)
P-5 (Paonia) Residence, near 2nd Street & Box Elder Avenue	270 ft. from tracks, partially shielded by neighboring houses	56	36	57 (eastbound)	---
H-1 (Hotchkiss) Non-residential Location on Sidewalk on 4th Street	40 ft. from tracks with unobstructed exposure to train noise	48	36	98 (eastbound) 84 (westbound)	106(eastbound with horn) 95 (westbound)
H-2 (Hotchkiss) Residence near 4th Street & High Street, outdoors	240 ft. from trucks, partially shielded by neighboring houses	48	36	76 (eastbound) 62 (westbound)	68 (eastbound) 82 (westbound)
H-3 (Hotchkiss) Residence near 4th Street & Orchard Street, outdoors	550 feet from tracks, entirely shielded by neighboring houses	50	35	53 (eastbound) 51 (westbound)	55 (eastbound) 59 (westbound)

The noise characteristics which affect the listener's response include overall loudness, sound pressure level, duration of exposure, time distribution of occurrence, and sound frequency. Other factors include the listener's total exposure, age, and individual susceptibility.

4.1 Overview of Noise Impacts

The focus of this analysis is centered on the mining and transportation activities for the operations of Bowie Resources Ltd. (Bowie) and Oxbow Mining Inc. (Oxbow) in the North Fork of the Gunnison River Valley near Paonia, Colorado.

General summaries of noise impacts associated with the Bowie and Oxbow operations are set forth in the following two tables:

- *Table N-4, Noise Impacts Associated With Bowie*; and
- *Table N-5, Noise Impacts Associated With Oxbow.*

Table N-4 Noise Impacts Associated With Bowie		
Project Item	**Impacts to Valley Towns (Somerset, Paonia, Hotchkiss, Delta)**	**Impacts to Nearby Rural Residents**
Construction of new conveyor and truck loading facility	No impact. Construction noise would not be audible at the town sites.	Minor impact. Construction noise would be discernible at a limited number of rural homes.
Increase surface operations at upper mine site	No impact. Routine operations would not be audible at the town sites.	Negligible impact. Noise from the upper mine site might be barely discernible at some rural homes during periods of exceptionally quiet background.
Noise from new conveyor and lower truck loading facility	No impact. Truck loading would not be audible at the town sites.	Minor impact. Noise from the new conveyor would increase nighttime noise levels at some rural homes during periods of exceptionally quiet background. The 24-hour L-dn noise level would probably increase by less than 1 dBA.
Increased coal truck traffic and commute vehicles along State Highway 133 and 92	No impact. Coal trucks not scheduled to travel through Paonia, Hotchkiss, or Delta.	Moderate to severe impact. Increased coal trucks are modeled to cause an L-dn noise increase at homes along State Highway 133.
Increase usage of train loading facility	No impact. Train loading would not be audible at urban areas of Paonia.	Minor impact. Noise levels at the facility boundary comply with the Colorado noise emission limits. Nighttime noise levels at rural homes nearest the train loading facility increase to about 49 dBA during the 2-hour loading period. The train loading noise is probably inaudible during the day, and is discernible but not intrusive at night.
Increased coal train traffic	Train whistles already cause severe impact at homes adjacent to tracks. Further, homes within 1 to 2 blocks of tracks are presently subjected to severe noise when trains pass. Anticipated future increases in train traffic would cause impacts on a more frequent basis.	

Typically, the noise emissions as a result of the operation of the surface facilities of the Bowie and Oxbow mines are not expected to be a general nuisance to nearby towns and residences. The major noise nuisances associated with these mines result from truck and railroad transportation of coal; these impacts are expected to occur on a more frequent basis with the future coal production increasing from 1998 levels at Bowie and Oxbow to the presently permitted coal production rates for the two mines. The transportation of coal from the West Elk Mine, operated by Mountain Coal Company L.L.C. (Mountain Coal) would add cumulatively to the noise nuisance impacts, primarily from the rail transport of coal from the underground mine operation east of Somerset.

Table N-6, Coal Train Estimates for Noise Calculations, lists the estimated number of daily train passages for the year 1998, as well as for the full coal production projected by Bowie, Oxbow and Mountain Coal for their mining operations in the North Fork Valley.

4.2 Noise Impacts During Exploration

Exploration drilling in the Iron Point Exploration License Area would generate some noise. Based on observations at other mineral exploration projects, noise from the drill rigs is expected to be barely

Table N-5 Noise Impacts Associated With Oxbow		
Project Item	**Impacts to Valley Towns (Somerset, Paonia, Hotchkiss, Delta)**	**Impacts to Nearby Rural Residents**
New portal construction	No impact to Paonia, Hotchkiss and Delta. Minor impact to Somerset. Construction noise would be temporary. Noise levels at Somerset would probably be less than 1 dBA above nighttime background.	Not applicable. There are no residents near the portal sites.
New portal operation (fans and conveyors)	No impact to Paonia, Hotchkiss and Delta. Minor impact to Somerset. Portal fans and new conveyor might be discernible at Somerset, but noise levels would probably be less than 1 dBA above nighttime background.	No applicable. There are no residents near the portal site.
Bear Creek vent raise fan	No impact. Vent raises would not be audible at any town sites.	Minor impact. Vent raise noise might be barely discernible at homes in the valley on an infrequent basis during exceptionally quiet periods.
Coal truck traffic and commute vehicles along State Highway 133 and 92	Moderate to severe impact to Somerset; coal trucks travel to Terror Creek Loadout. No impact to negligible to Paonia, Hotchkiss and Delta. Coal trucks not scheduled to travel through these towns.	Moderate to severe impact. Coal trucks cause noise to homes along State Highway 133 between Somerset and Terror Creek Loadout.
Increased surface operations (not applicable - proposed action would not result in increased surface operations)	No applicable.	No applicable
Increased coal train traffic	Train whistles already cause severe impact at homes adjacent to tracks. Further, homes within 1 to 2 blocks of tracks are presently subjected to severe noise when trains pass. Anticipated future increases in train traffic would cause impacts on a more frequent basis.	

audible at a distance of 2 to 3 miles during quiet parts of the day. It is unlikely that noise levels at any home sites would be more than 1 dBA above the daytime background. Noise impacts would also be of limited duration.

4.3 Noise Impacts From Surface Facilities

Noise from routine mining activities at the surface facilities of Bowie and Oxbow would not create any unacceptable noise levels at the nearest homes. Measurement of noise levels near the surface facilities of these mines showed that ambient noise levels are low. *Table N-7, Measured Noise Emissions From Mines*, shows noise readings taken near the Bowie and Oxbow mines. Noise levels taken at the valley floor beneath the Bowie No. 2 Mine surface facilities were 39 to 46 dBA and were scarcely discernible above background noise. Noise readings taken by Oxbow at the homes nearest their surface operation were 55 to 61 dBA, and those noise readings were dominated by public traffic along State Highway 133.

Table N-6
Coal Train Estimates for Noise Calculations

Item	Assumed Value for 1998 Coal Train Traffic	Assumed Value for All Alternatives
Oxbow Production Rate	1.5 million tons/year	5.0 million tons/year
Bowie No. 2 Production Rate	1.2 million tons/year	5.0 million tons/year
Mountain Coal Production Rate	5.9 million tons/year	8.2 million tons/year
Combined Production Rate for 3 Regional Mines	8.6 million tons/year	18.2 million tons/year
Coal Train Payload	10,500 tons/train	10,500 tons/train
Number of Daily Coal Trains	2.2 eastbound 2.2 westbound	4.7 eastbound 4.7 westbound
Duration of Train Passage	5 minutes	5 minutes
Minutes per Day of Passing Trains	22 minutes/day	47 minutes/day

Table N-7
Measured Noise Emissions From Mines

Time of Day	Condition	Noise Levels in dBA		Predominant Noises
		L-eq	L-max	
Noise From Mining and Coal Processing Activities at Bowie No. 2 Mine Upper Surface Facility				
4/25/99 at night	Coal conveyor discharge onto coal pile; 70 feet distance	79		
	Coal crusher; 100 feet distance	81		
	Covered coal conveyor from mine to crusher; 25 feet distance	79		High-pitched clanging of rollers and belt
	Coal stacker tower discharging onto open coal pile; 80 feet distance	82		High-pitched noise
	General facility noise without coal stacker; 250 feet from center of activity	75		
	General facility noise including coal stacker tower; 150 feet from tower	82		Coal stacker was the loudest noise at the facility
Noise From Upper Bowie No. 2 Mine Surface Facility, Measurements Taken at Mine Office at Bottom of Valley; 3,200 Feet From Upper Facility				
4/25/99 at night	Combined surface operations not including coal stacker tower	39-41	41	Mine noise was barely discernible when coal stacking tower was not operating
	Coal stacker tower and other combined surface operations	41-46	46	Coal stacker was the loudest noise at the facility
Noise From Adjacent to Oxbow Coal Train Loadout in Somerset				
10/27/99 midday	Noise measured at closest home - no coal train loading	55-60	71	Public traffic on State Highway 133
	Noise measured during coal train loading	60-68	81	Loudest noise measured by passing locomotives

Under certain meteorological conditions with quiet background, it is possible that noise from the surface facilities of the Bowie No. 2 Mine could be audible at Garvin Mesa, approximately 2 miles west of the surface facilities. Under certain conditions, the noise could be perceptible as a nuisance. Generally, however, environmental impacts of that relatively quiet noise would be minor. Most of the noise from the surface facilities at the Bowie No. 2 Mine would be blocked by a pronounced ridge west of the facility.

L-max noise emissions from the stationary mining equipment at the Bowie and Oxbow mines are regulated by the Colorado noise statute, which sets limits on the L-max at the facility boundary. As shown in *Table N-8, Noise Levels at Mine Site Boundaries and Comparison With Colorado Noise Statute*, the L-max noise levels that were measured near the Bowie and Oxbow surface facility boundaries were well below the allowable 90 dBA daytime limits and generally below the 75 dBA nighttime limit.

Table N-8
Noise Levels at Mine Site Boundaries and Comparison With Colorado Noise Statute

Mining Operations	Approximate Distance to Facility Boundary	Noise Level at Facility Boundary (L-max)	Colorado Noise Statute (L-max)
Bowie No. 1 Coal Train Loading Facility	150 feet	76 dBA (calculated)	Daytime = 90 dBA Nighttime = 75 dBA
Bowie No. 2 Mine; New Coal Conveyor	500 feet	60 dBA (calculated)	Daytime = 90 dBA Nighttime = 75 dBA
Bowie No. 2 Mine; Upper Surface Operations	3,500 feet	45 dBA (measured)	Daytime = 90 dBA Nighttime = 75 dBA
Oxbow Mine Coal Loading: Continuous Noise at Loadout Hopper	100 feet	68 dBA (measured)	Daytime = 90 dBA Nighttime = 75 dBA
Oxbow Mine Coal Train Loading Facility: Locomotive Passing for 3 Minutes	100 feet	79 dBA (measured)	Daytime = 90 dBA Nighttime = 75 dBA

4.4 Noise Impacts From Ventilation Fans

Ventilation fans are part of the surface facilities of the mining operations. See Section 4.3, Noise Impacts From Surface Facilities.

Ventilation fans would generate a “white noise” sound that would be barely discernible at a distance of 3 to 4 miles. The new “intake” ventilation fan operated at the Bowie No. 2 Mine is quieter than the old “exhaust” fan that operated until it was replaced in late 1999 by the new fan. Oxbow plans to install a new “exhaust” ventilation fan for the Elk Creek portal. It is unlikely that this new ventilation fan would be discernible at homes in Somerset since it would be farther distant than the current Sanborn Mine fan.

4.5 Noise Impacts From Train Loading Operations

Noise readings conducted on October 29, 1999 by Air Sciences, Inc. (under contract to Oxbow) at the Oxbow train loading facility at Somerset indicated that the train loading operation complied with Colorado noise statutes. Readings were taken at the closest relevant receiver locations: the front yards of dwellings immediately across State Highway 133 and facing the coal train loading operation. Continuous noise readings were taken during continuous coal loading. The maximum level during coal loading was 68 dBA, which is less than the nighttime Colorado statute limit of 75 dBA. The maximum

noise level during a 10 minute period when the locomotive slowly passed close to the noise monitor was 81 dBA, which is less than the 90 dBA daytime limit, but slightly higher than the 75 dBA nighttime limit. The average L-eq over the entire loading cycle was approximately 63 dBA, which is slightly higher than the background level of 56 dBA when there was no coal train loading.

Noise readings taken on Garvin Mesa near the Bowie No. 1 Loadout showed that the facility complies with the Colorado noise statutes at the facility boundary. *Table N-9, Noise Readings at Garvin Mesa During Train Loading*, summarizes the noise readings that were taken on April 23, 1999. Readings were taken at several locations before coal train loading began, as well as during coal train loading. The L-eq noise level at the Dierken residence (the closest Garvin Mesa home with a direct view of the Bowie No. 1 Loadout) was 36 dBA during the pre-dawn period just before train loading began. The L-eq and L-max at the Dierken residence were 49 dBA and 53 dBA during train loading, at a location with a direct line of sight to the train loadout. The L-eq and L-max at a spot where the Dierken residence did not have a direct line of sight to the train loadout were 39 dBA and 42 dBA, respectively.

The Colorado noise statute does not regulate noise levels at residential areas, so it cannot be used to define an "environmental impact." Therefore, the measured levels at the Dierken residence were compared to allowable limits for the states of Washington and Oregon that do have rigorous residential noise limits. *Table N-9, Noise Readings at Garvin Mesa During Train Loading*, compares the measured noise levels on Garvin Mesa against the Washington and Oregon state noise limits. Those noise statutes set limits on L-max, L-eq, L-25, and L-10 of noise at the property line of the receiving property. The noise levels measured at the Dierken property at the location directly overlooking the Bowie No. 1 Loadout were less than the Washington and Oregon state noise limits.

4.6 Noise Impacts From Train Whistles

Federal train safety laws require trains crossing public roads to sound their whistles at least once within a 0.25 mile of each public grade crossing. Train whistles sounded at night would exceed the Colorado statutes that limit the L-max noise level to 75 dBA at the edge of the railroad right-of-way. It is unclear which regulation takes precedence: the federal law requiring the train to sound its whistle, or the Colorado noise statute which restricts the loud noise caused by the whistle.

There are numerous public railroad grade crossings within Delta County, specifically in the towns of Paonia, Hotchkiss, and Delta. Homes near these crossings are already impacted by severe noise from train whistles, and increases in train traffic from 1998 levels to the levels proposed in *Table N-6, Coal Train Estimates for Noise Calculations*, would exacerbate the existing noise problem.

Noise readings of train whistles were taken at two railroad grade crossings on the night of April 21, 1999. A train whistle blown an estimated 200 feet from the crossing at 4th Street in Hotchkiss caused an L-max noise level of 106 dBA and an L-eq reading of 98 dBA. See *Figure 29, Train Noise at Hotchkiss*, in the EIS figure volume.

A whistle blown an estimated 100 feet from the crossing at 2nd Street in Paonia caused an L-max noise level of 110 dBA and an L-eq reading of 100 dBA; see *Figure 27, Train Noise at Paonia*, in the EIS figure volume.

Both these noise readings were taken at a distance of approximately 30 to 40 feet from the railroad tracks, and at a distance of approximately 100 to 200 feet in front of the train.

Table N-9
Noise Readings on Garvin Mesa During Train Loading

Measurement Location and Scenario	Discernible Noises	L-max (dBA)	L-25 (dBA)	L-50 (dBA)	L-eq (dBA)
Back patio of Dierken residence (1660 4100 Road). Direct view of train loading station. Daytime, no train loading.	Barely discernible fan noise from baghouse on loadout. Passing traffic on Highway 133.	59	56	54.5	55
Terror Creek Winery. Daytime, no train loading.	No industrial sounds. Birds, routine rural noises.	61	53	49	53
Terror Creek Winery. Pre-dawn, during train loading.	No industrial sounds. Birds, routine rural noises. Water trickling in distant drainage ditch.	46	43	40	44
Back patio of Dierken residence (1660 4100 Road). Direct view of train loading station. Pre-dawn, before start of train loading.	Barely discernible fan noise from baghouse on loadout. Passing traffic on Highway 133.	38	35	34	36
Front yard of Dierken residence (1660 4100 Road). No direct line of sight to train loading station. Pre-dawn, during train loading.	Clearly discernible noise from train loading operation. Routine rural sounds (birds, etc.).	42	40	38	39
Back patio of Dierken residence (1660 4100 Road). Direct line of sight to train loading station. Pre-daw, during train loading.	Clearly discernible noise from train loading operation. Routine rural sounds (birds, etc.).	52.6	49.7	48.6	48.6
Non-residential area along Road 4175, mid-way between Highway 133 and nearest home. Spot reading taken while train was backing into the loadout.	Constant noise of locomotive backing into the coal loading facility.	--	--	--	57
Non-residential area along Road 4175, mid-way between Highway 133 and nearest home. 20-minute reading taken while train was loading coal.	Trucks and RVs on Highway 133. Constant mechanical noise from coal loading.	59	55.63	54.6	54.8
Washington state noise limits at receiving property (residential, nighttime limit)		65	50	--	49
Oregon state noise limits at receiving property (residential, nighttime limit)		60	--	50	50

Notes:
1. All readings taken using Larson-Davis Model 720 noise meter with “slow” response time.
2. All readings taken during cool, calm weather conditions.
3. Train loading readings taken on the morning of 4/23/99 between 04:35 and 08:00.

Informal observations of whistle noise (those with no electronic noise readings) were made from Road 4175 at the base of Garvin Mesa, about 1 mile from the train whistle. The observations were made during the pre-dawn hours of April 23, 1999 during calm conditions when the background noise level was about 36 dBA. The whistle noise was clearly audible above the quiet background.

4.7 Noise Impacts From Coal Trains (Excluding Whistles)

Noise measurements showed that train noise (excluding whistles) varied considerably depending on the speed of the train, the distance from the track, and the presence of buildings between the tracks and the receiver.

Noise from a fast-moving train would be much higher than the noise from a slow-moving train. For example, the noise from one westbound train moving through Paonia, at a speed of approximately 10 miles per hour, was estimated to have an L-eq noise level of 61 dBA and an L-max level of 68 dBA, approximately 125 feet from the tracks. On the contrary, a train moving approximately 25 miles per hour through Hotchkiss, would have an L-eq level of approximately 79 dBA and an L-max level of 90 dBA at a distance of 125 feet. These noise levels were based on actual noise readings at receiver P-1 as shown on *Figure 28, Train Noise at Paonia (4-23-99)* and receiver H-1 shown on *Figure 29, Train Noise at Hotchkiss (4-21-99 and 4-23-99)*.

The L-eq noise levels measured at homes two blocks from the railroad tracks were greatly reduced due to shielding by intervening buildings. For example, at Hotchkiss, the L-eq measured at receiver H-2 (two blocks from the tracks with many intersecting buildings) was 31 dBA quieter than the noise at receiver H-1 adjacent to the tracks. According to standard noise theory, the noise reduction over that two block distance would have been only 12 dBA without any intervening buildings.

Projected future coal production from the three mines in the North Fork Valley would cause an increase in train traffic. See *Table N-6, Coal Train Estimates for Noise Calculations*. The increased train traffic would continue to cause severe noise impacts at homes next to the tracks, as well as causing severe noise impacts to homes located within one to two blocks from the tracks.

The noise impact caused by increased coal train traffic was evaluated using the FTA methodology, which is based on increases of the 24-hour average noise level (L-dn). For this assessment, the projected L-dn for all alternatives (including the No-Action Alternative and the coal train traffic cumulatively contributed by the West Elk Mine) was compared to the historical L-dn for the year 1998. The year 1998 was selected because that was the start of the EIS process.

The historic 1998 L-dn and the projected L-dn were calculated for each of the representative urban noise receivers in Paonia and Hotchkiss. At each representative receiver, the increase in the calculated L-dn was evaluated using the FTA assessment methodology. The calculated L-dn for each of the representative receivers are listed in *Table N-10, Coal Train Noise Levels in Paonia and Hotchkiss for Historic 1998 vs. Projected Maximum Coal Tonnages*. The calculated L-dn noise increases at each receiver are plotted on a revised *Figure 30A, Noise Impact Evaluation Using Federal Transit Administration Criteria*. This revised figure is included in Section 3.12, Noise, of the main EIS text.

The measured noise levels at two noise receivers within 30 to 40 feet of the tracks (receiver P-4 in Paonia and receiver H-1 in Hotchkiss) were scaled downward to estimate their noise levels at a distance of 125 feet from the tracks. This calculation was completed to estimate the impacts that would occur at homes 25 feet outside the railroad right-of-way.

Based on the calculated increases in the 24-hour L-dn, as shown on the revised *Figure 30A, Noise Impact Evaluation Using Federal Transit Administration Criteria*, the following comments are made.

- Homes near the railroad tracks without any intervening buildings between them and the tracks would be subject to a severe impact.

- Homes more than about one block from the railroad tracks that are partially shielded by adjacent buildings would be subjected to noise levels above non-train background levels, but the noise levels would not be considered severe according to FTA noise criteria.

- Homes more than about two blocks from the railroad tracks that are shielded by intervening buildings would perceive noise levels during the daytime that would be only slightly higher than background levels. Although the noise from passing trains would be audible during quiet nighttime periods, the nosie of passing trains (excluding whistles) would not be expected to disrupt sleep or normal conversations of individuals living more than two blocks from the railroad tracks under most conditions.

Table N-10
Coal Train Noise in Paonia and Hotchkiss for Historic 1998 vs. Projected Maximum Coal Tonnage[1]

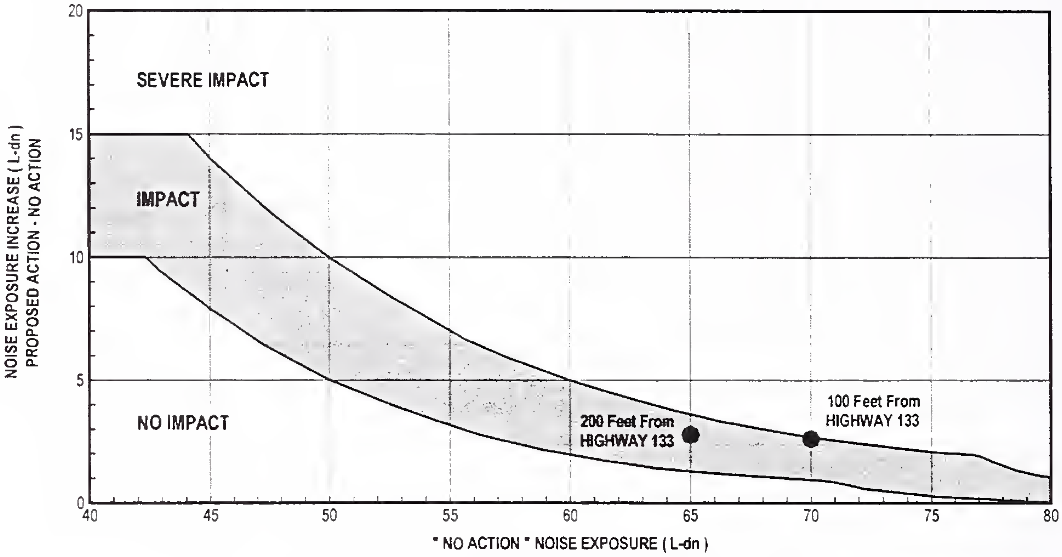
Location	Orientation of Tracks	L-dn for No-Action	L-dn for Proposed Action
P-1 (Paonia) Residence near 1st & Main, outdoors	115 feet from tracks, partially shielded by neighboring houses	59 dBA	62 dBA
P-2 (Paonia) Residence 118 Main Street, outdoors	490 feet from tracks, mostly shielded by neighboring houses	50 dBA	53 dBA
P-3 (Paonia) Residence 224 Main Street, outdoors	800 feet from tracks, entirely shielded by neighboring houses	52 dBA	53 dBA
P-4 (Paonia) Non-residential location on sidewalk on 2nd Street	30 feet from tracks, with unobstructed exposure to train noise	87 dBA	90 dBA
P-4 (at 125 feet)	Measured value at P-4, scaled to estimate noise level at the right-of-way 125 feet from tracks	82 dBA	85 dBA
P-5 (Paonia) Residence near 2nd Street & Box Elder Avenue, outdoors	270 feet from tracks, partially shielded by neighboring houses	55 dBA	56 dBA
H-1 (Hotchkiss) Non-residential location on sidewalk on 4th Street	40 feet from tracks with unobstructed exposure to train noise	84 dBA	88 dBA
H-1 (at 125 feet)	Measured value at H-1, scaled to estimate noise level at the right-of-way 125 feet from tracks	80 dBA	88 dBA
H-2 (Hotchkiss) Residence near 4th Street & High Street, outdoors	240 feet from tracks, partially shielded by neighboring houses	63 dBA	66 dBA
H-3 (Hotchkiss) Residence near 4th Street & Orchard Street, outdoors	550 feet from tracks, entirely shielded by neighboring houses	49 dBA	50 dBA

Note: 1. See *Table N-6, Coal Train Estimates for Noise Calculations*

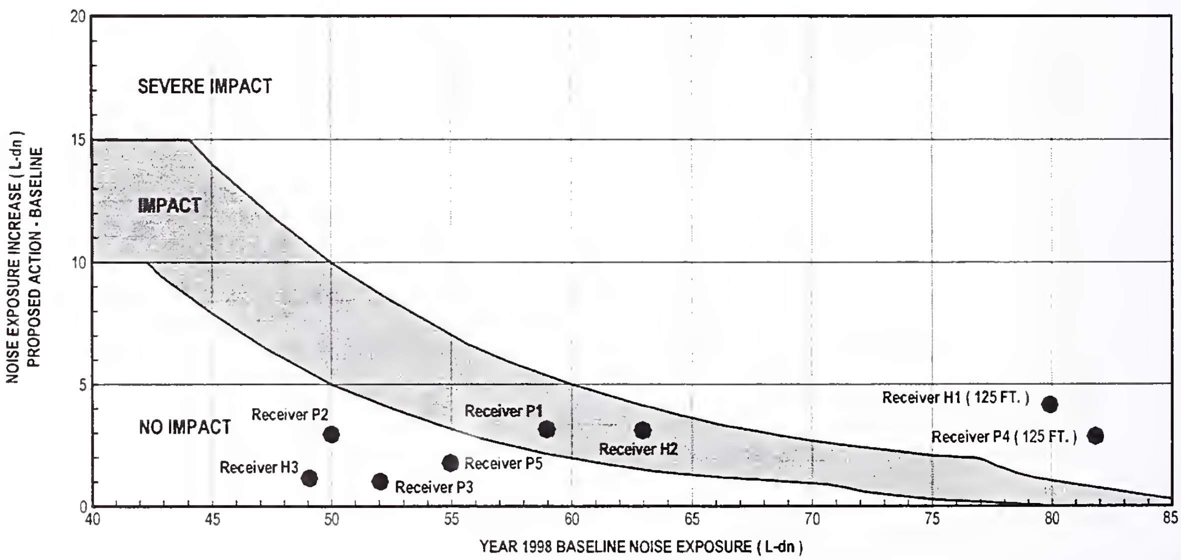
4.8 Noise Impact From Coal Trucks

Coal truck traffic on State Highway 133 can cause noise impacts to homes within 200 feet of the highway. Within 100 feet of the highway right-of-way, homes would experience a severe impact.

Based on a visual survey of the highway between the Bowie No. 2 Mine and the Bowie No. 1 Loadout, about half of the homes along that section were within 200 feet of the highway. A limited number of



IMPACTS OF TRAFFIC INCREASES ON HIGHWAY 133



IMPACTS OF INCREASED COAL TRAINS

FIGURE 30A
NOISE IMPACT EVALUATION
USING FEDERAL TRANSIT ADMINISTRATION CRITERIA

homes were within 100 feet. Homes located more than 200 feet from the highway should be far enough that they would not be impacted by coal truck traffic noise. The STAMINA computer model developed by the FHWA was used to estimate the hourly average noise levels and the 24-hour L-dn noise level at the arbitrary receiver locations of 100 and 200 feet from the highway. *Table N-11, Noise Impacts From Traffic Along State Highway 133*, lists the assumed daytime and nighttime traffic volumes for an assumed existing traffic load and the projected load under the EIS alternatives. Annual average daily traffic (ADT) for 1996 for State Highway 133 were obtained from the Colorado Department of Transportation. The ADT on State Highway 133 near Paonia was 3,150 vehicle passes per day. The ADT data do not include a breakdown of cars versus trucks. For purposes of calculating the daytime and nighttime noise impacts, the following assumptions were made.

- The coal trucks were assumed to operate 24 hours per day. The truck usage at a production rate of 2 million tons per year is approximately 196 coal trucks per day. Coal truck usage corresponding to a production rate of 5 million tons per year is 489 coal trucks per day.

- Non-project vehicles were divided into the following categories: 70 percent cars, 20 percent medium trucks, and 10 percent heavy trucks.

- It was assumed that the daytime hourly rate of non-project vehicles was twice the nightly hourly rate.

- The number of delivery trucks was estimated to increase threefold for the EIS alternatives while continuing to operate over an 8-hour day shift. It was also estimated that there would be twice as many mine commuters for the expanded production rates under the EIS alternatives, and that these commuters would now travel 24-hour per day.

- All vehicles were assumed to travel at 55 miles per hour, which is the posted speed limit.

The maximum L-eq(h) noise level for the assumed existing traffic is 65 dBA at a distance of 100 feet from the highway. The peak L-eq(h) is less than the 67 dBA criterion that the FHWA uses to define a severe noise impact. Therefore, it is concluded that none of the homes along State Highway 133 are currently severely impacted.

For the EIS alternatives, the maximum L-eq(h) noise level is 67 dBA at a distance of 100 feet from the highway and 66 dBA at a distance of 200 feet. Under the EIS alternatives, it is assumed that homes closer than 100 feet from the highway would be impacted by short-term noise impacts using FHWA criterion.

The increases in the 24-hour average L-dn between the assumed existing traffic loads and the EIS alternative traffic loads are plotted on the FTA Noise Assessment Chart in revised *Figure 30A, Noise Impact Evaluation Using Federal Transit Administration Criteria*. The increase in the 24-hour L-dn at both the 100-foot and 200-foot distances from State Highway 133 would constitute an impact according to FTA methodology. The L-dn increase of 3 dBA at both the 100-foot and the 200-foot locations is caused by the increase in nighttime truck traffic.

Table N-11 Noise Impacts From Traffic Along State Highway 133				
	Assumed Existing Traffic Loads		Traffic Loads Under EIS Alternatives	
	Day (veh/hr)	Night (veh/hr)	Day (veh/hr)	Night (veh/hr)
Non-project Vehicles				
Cars	113	57	113	57
Medium Trucks	32	16	32	16
Heavy Trucks	16	8	16	8
Total Non-project Vehicles	161	81	161	81
Project: Coal Trucks	15	15	40.75	40.75
Project: Delivery Trucks	1.25	--	3.75	--
Project: Mine Commuters	12.5	--	12.5	12.5
Total Cars	126	57	126	70
Total Medium Trucks	33	16	36	16
Total Heavy Trucks	31	23	57	49
TOTAL VEHICLES	**190**	**96**	**219**	**135**
L-eq(h) (dBA) (100 ft/200 ft)	65/60	63/58	67/62	66/61
L-dn (dBA) (100 ft/200 ft)	70/65		73/68	

5.0 NOISE MITIGATION

The noise evaluation completed for this EIS illustrated that train whistles and coal train traffic cause severe noise impacts to homes near the tracks. In addition, coal truck traffic along State Highway 133 can cause an impact to homes closer than 200 feet to the highway.

The following are noise mitigation measures that could be used in reducing the impacts.

- Additional noise readings and surveys could be undertaken to assess the L-max noise level of train whistles at numerous locations near highway grade crossings. In addition, additional noise readings could be made to confirm the effectiveness of reducing train speed as a noise mitigation measure. As part of this additional survey work, an inventory of homes and businesses near each grade crossing in Delta County could be made to assess how many homes are currently severely impacted by train whistles and passing trains. This survey work would provide additional data, but the overall conclusions from additional survey work would probably confirm the EIS noise assessment.

- Coal trains passing through populated areas could be slowed down to reduce the power load on the locomotive and thus probably reduce the noise. It was observed that west bound trains traveling slightly downhill (with a low engine load) were quieter than east bound trains traveling slightly uphill (with a high engine load).

- Noise mitigation could be applied directly to homes that are adjacent to the railroad tracks. Improvements such as double-pane windows have proven to be effective in reducing noise impacts near highways and airports. These improvements are very effective when the windows are closed, but they are ineffective if the windows are open on warm days.

- Noise walls could be installed at locations where trains and coal trucks pass close to homes. Noise walls would prove highly effective, but are highly localized noise reductions. Careful consideration must be given to potential traffic safety concerns that would be created if noise walls reduced visibility at railroad grade crossings or to the highway.

- The noise from coal train whistles is most pronounced immediately in front of the train. Noise impacts to homes next to tracks at grade crossings could be eliminated if crossings are closed.

- The speed of the coal trucks could be reduced. The noise modeling was completed using the posted speed limit of 55 miles per hour. Reducing the allowable speed of the coal trucks would reduce the noise impacts.

- Relocation of the Bowie No. 1 Loadout to a new location adjacent to the Bowie No. 2 Mine would eliminate noise impacts that are currently caused by coal trucks traveling on State Highway 133 between the two facilities. Relocating the train loadout would also eliminate the current minor noise effects to homes on Garvin Mesa close to the present Bowie No. 1 Loadout. However, the noise from a new loadout at the Bowie No. 2 Mine could increase noise levels to a small number of homes within 1 mile of the new location.

Third Party Contractor
S. Edwards Inc.

RECORD OF DECISION
TABLE TOP EXPLORATORY OIL AND GAS WELL
CHEVRON, USA

U.S.D.A. FOREST SERVICE, REGION 4
WASATCH-CACHE NATIONAL FOREST
EVANSTON RANGER DISTRICT

SUMMIT COUNTY, UTAH

INTRODUCTION

This document contains my decisions regarding Chevron, USA's proposal to construct and drill an exploratory oil/gas well in the Main Fork drainage on the Evanston Ranger District.

Specifically, I needed to determine by this decision:

1. Whether or not to approve the Surface Use Plan of Operations submitted with the Application for Permit to Drill (APD).
2. How to access the well site.
3. Whether or not to authorize the Bureau of Land Management (BLM) to grant an exception to the No Surface Occupancy lease stipulation in relation to the proposed road location.
4. Whether or not to authorize the use of existing Forest System roads.
5. Future management of the road to the well site (if access is by road.)

These site-specific decisions implement the goals and objectives from the Wasatch-Cache National Forest Land and Resource Management Plan (Forest Plan), approved on September 4, 1985 by J.S. Tixier, Regional Forester for the Intermountain Region, U.S.D.A. Forest Service. The Forest Plan guides all natural resource management activities for the Wasatch-Cache National Forest. The Chevron Table Top Prospect Exploratory Oil Well Environmental Impact Statement (EIS) is the site specific analysis document that evaluates management practices proposed to achieve the goals and objectives of the Forest Plan within the Main Fork drainage. (Please refer to map.)

Subsequent to making the above listed decisions within the authority of the Forest Service, the BLM, having been a cooperating agency in the preparation of the EIS, will formally adopt that analysis and make the following decisions:

1. Whether or not to approve the "Drilling Plan" and the APD as a whole, which incorporates the Forest Service decision relative to the Surface Use Plan of Operations.

2. Whether or not to grant an exception to the No Surface Occupancy lease stipulation relative to the proposed road location.

DECISION

After careful review of the Final EIS and public comments, I believe I have reached decisions that are sound and give balance to resource management in the area. My rationale for the decisions I have made is

presented below. Throughout this decision making process, I used the analysis that was available through the EIS, the feedback I received from the public in the way of comments on the EIS, and my experience and knowledge of the laws, regulations, and expectations facing the Forest Service and, in particular, the Wasatch-Cache National Forest.

My decision is to implement the Proposed Action as it was described in the EIS. In the EIS, the Proposed Action was described as the Forest Service's Preferred Alternative:

> drilling, completing, and testing, and possible production at, a single exploratory oil well on 3.43 acres in T1N., R10E., SW1/4, SW1/4, Section 16 (Alternative Well Site A).
>
> restoring 0.8 mile of Stillwater Road (Forest Road No. 057), improving 2.1 miles of Peninsula Road (Forest Road No. 306), constructing 2.0 miles of road on the west side of the Main Fork stream, constructing a bridge across the Main Fork and constructing 0.8 mile of new road to the proposed well site, and reclaiming 2.4 miles of old 4wd trail in the Main Fork drainage (Forest Road No. 097).
>
> constructing a .5 acre gravel source pit in T1N., R10E., NE1/4, NE1/4, Sec. 8 (Alternative Gravel Site C) to provide gravel to surface the existing and new road and well pad.
>
> graveling 5.7 miles of the road into the well site and the 3.43 acre well pad
>
> drilling a temporary water well on the well pad to provide water for drilling and dust control, or if the well does not provide a sufficient amount of water, installing a temporary water pipeline to the location and/or hauling water from another source (if needed).
>
> reclaiming all surface disturbance at the well site if the well is not successful.
>
> constructing a 4,000 square foot parking area/trailhead near the Main Fork bridge.

The following section describes each part of my decision with specific rationale. More general rationale for these decisions are presented later in this document. Hopefully this will enable the reader to get a feel for the broader picture.

<u>We will approve the Surface Use Plan of Operations submitted as part of the Application for Permit to Drill (APD) for Alternative Well Site A</u>

Alternative Well Site A has approximately two less miles of road construction than Alternative Site B, within country having unroaded characteristics. Either site is suitable for drilling the exploratory well as far as subsurface geology is concerned. It is quite clear to me that Site A will impact the least amount of ground and other resources as compared to Site B.

Several access routes into the area were looked at but eliminated from detailed study early in the process. The Hayden Fork Road Alternative was eliminated because of the obvious need for extensive fill required to cross wetland and riparian habitat directly adjacent to the Mirror Lake Highway. Once this is done, access is gained only to a point where the existing road through the Peninsula area already exists.

The Amoco Road Alternative was also eliminated early in the process. At one point, this route reaches to within .5 mile of the Christmas Meadows summer home area and has to traverse an area of bogs and large boulders.

Once the mouth of the Main Fork drainage is reached, all the access routes are confined to one side or the other of the Main Fork stream in the bottom of the drainage. The greatest difference between the access alternatives dealt mostly with gaining access to the mouth of the drainage. Since the existing Peninsula

Road already reaches within .25 mile of the mouth of the drainage, it would involve the least amount of new disturbance.

Alternative well sites located in developed areas were also considered but eliminated from detailed study. Moving the well site away from the target geologic structure would require directional drilling in order to reach the objective. The increased cost of directional drilling along with the extreme risk of being able to technically complete the hole, eliminated this alternative from detailed study.

Another method of access strongly suggested by several interested publics was helicopter access. This alternative was considered but eliminated from detailed study early in the EIS. Several factors caused this. (1) Helicopter activity would be continuous for an estimated 27 weeks during pad construction and drilling operations. There would be another 2 weeks of helicopter activity associated with reclamation if the well is not productive. The flight path would lie between four developed campgrounds and a summer home area. (2) an additional staging area, approximately the size of the drill pad, would have to be constructed for loading and off loading equipment and for a landing/refueling area for the large helicopter(s) at the end of the Peninsula Road. (3) The drilling equipment capable of doing the job is located outside North America and the cost of transporting this equipment to this project area would be extremely high in addition to the expense of using a helicopter to support the drilling operations which can be 10 times greater. The cost for helicopter supported drilling was also greater than the cost to reclaim the newly constructed or relocated roads in the Main Fork drainage which would also leave the drainage in an unroaded condition. I very seriously considered this helicopter access option because it would have eliminated the need for an access road. But the disadvantages listed above for economics and resource concerns outweighed, in my judgement, the advantage especially since the disturbance from helicopter activity would be spread out across a larger area including the Christmas Meadows summer home area and potentially the Wilderness.

The alternative gravel source sites are all located along the Peninsula Road. Samples from the different sites indicate that Alternative Gravel Source C has more of the clay needed to bind the coarser gravels together. Maintenance costs and road repairs would be less in the long run.

All mitigation measures and conditions developed to address impacts of implementing the proposed action identified in Chapters 2 and 4 of the EIS, the Biological Assessment/Evaluation, and the following appendices will be carried forward as conditions of approval for the Surface Use Plan of Operation.

Appendix A - Authorizing Actions
Appendix B - Application for Permit to Drill and Surface Use Plan
Appendix C - Road Construction Criteria
Appendix D - Summary of Mitigation and Monitoring
Appendix E - Erosion Control and Reclamation

Best Management Practices (BMPs) (Soil and Water Conservation Handbook) guided development of these measures, criteria, and conditions.

Construction activities on the lease or within the Unit will be delayed until July 1 to minimize effects on wildlife in the area and to ensure that the bridge across the Main Fork is installed during low water conditions. The determination as to when activities may commence will be based on visual monitoring of the water level and decline of spring runoff by District personnel.

A small trailhead will be constructed on the west side of the Main Fork near the new bridge to provide parking for those wishing to hike into the Hell Hole region of the High Uintas Wilderness. Use of the Hell Hole area could increase; however, this increase may mean that the use in other portions of the Wilderness may decrease. I realize that those who have used Hell Hole because of its seclusion will not appreciate the potential increase in use.

If the well is unsuccessful, the new road on the east side of the Main Fork will be fully reclaimed. All gravel surfacing will be removed for use elsewhere. The road will be shaped to as near preconstruction appearance as reasonable, and reseeded. The new bridge will be removed. In other words, if the well is unsuccessful, there will be no road access on the east side of the Main Fork.

Once the construction and drilling operations are finished, the public will be allowed to use all of the access road during the summer months, except for the new bridge across the Main Fork and the road between the bridge and the drill site. This will afford the public increased opportunities for dispersed camping in the vicinity of the Mirror Lake Highway, and to visit the Howe Flume Historic District as a result of the improved access road. The road behind the existing bridge on the Stillwater Fork will be closed to all public motorized travel from September 15 until such time in the following spring that road conditions and goshawk activity permit.

<u>We will authorize the Bureau of Land Management (BLM) to grant an Exception to the No Surface Occupancy (NSO) stipulation</u>

The road alignment up through the Main Fork drainage will cross two parcels of land where a NSO stipulation has been applied to the lease that covers those areas. The first location is in T.1N., R.10E., N 1/2 SE 1/4 of Section 17 and the second is T.1N., R.10E., NW1/4 of Section 21. These lands are not on the lease being developed and the NSO stipulation is only applicable due to those lands being within the Exploratory Unit.

The lease, U-54044, states the following resource management concerns for the NSO stipulation:

-erodible soils
-moderate visual resources
-high recreation value and/or
-Christmas Meadows Recreation Area withdrawal

These reasons for application of the NSO stipulation have been addressed in the Final EIS (FEIS). The NSO stipulation was applied generally to the lease as a whole. Where resource management concerns underlying or requiring use of a stipulation can be avoided and/or mitigated or if new technology has come to light which mitigates impacts to acceptable levels, modification of stipulations is fully justifiable if analyzed through the NEPA process with appropriate public involvement. Each resource concern underlying the NSO stipulation has been addressed in the EIS, draft and final, and it finds that 1) by careful location and design of the road, areas of steep slopes and erosion hazard are avoided; 2) the Forest Plan visual quality objective can be met; 3) the recreation value is not high when evaluated by the criteria on page IV-37 of the Forest Plan; and 4) the area involved is not within the Christmas Meadows Recreation withdrawal. All practicable means have been adopted to avoid or minimize environmental impacts that may result from the alternative selected. The selected alternative incorporates the mitigation measures, road and drill pad construction criteria and Best Management Practices discussed in the EIS. The Forest-Wide and Management Area Standards and Guides also ensure environmental impacts are minimized. Therefore, I believe it appropriate to authorize the granting of an exception to the NSO stipulation.

The drill site location is not located in an area with a NSO stipulation.

<u>We will authorize the use of existing off lease Forest System roads</u>

Chevron will be authorized to use the following existing Forest Roads. These roads are necessary to provide access between Highway U-150 to the lease unit:

1. Stillwater Road (Forest Road #057) from its junction with Highway U-150 to its junction with the Peninsula Road. Approximately 0.8 mile.

2. Peninsula Road (Forest Road #306) from its junction with Stillwater Road to lease unit boundary (halfway mark in Section 5, T.1N., R.10E.). Approximately one mile.

We will modify the existing Travel Plan

The Wasatch-Cache Travel Plan which governs vehicular access to National Forest lands, including use of off-highway vehicles, will be updated to show the road from the bridge over the Stillwater Fork to the new bridge on the Main Fork as a designated route for public travel once construction and drilling operations have been completed. The road behind the existing bridge on the Stillwater Fork will be closed to all public motorized travel from September 15 until such time in the following spring that road conditions and goshawk activity permit. The opening of the road will be determined by district personnel in consultation with a professional wildlife biologist. This action will promote a higher quality hunting experience and will provide greater security for migrating elk in November. In addition, the spring restrictions will minimize road damage and disturbance to goshawks during the nesting period.

We will redelineate designated old-growth tree stand boundaries through a nonsignificant Forest Plan amendment

In the Forest Plan, old-growth stands of conifers were identified for protection. When these stands were identified, the existing Peninsula Road did not appear on any of the maps being used and consequently the designated stand included a road which split the stand into sections having approximately 25 and 284 acres apiece. During the process of this analysis, lands of the same capability classification were located directly adjacent to the larger of the two sections. Twenty five acres will be added to the larger section and designated for protection to replace the smaller section.

We will require monitoring to ensure management activities have the anticipated impacts and consequences

Implementation of the preferred alternative requires monitoring of sensitive wildlife species and water quality.

Goshawk Nest Monitoring.
Monitoring of the goshawk nest will be conducted by Forest Service biologists at all stages of the project to determine if and at what point project activity is having a detrimental effect. If a detrimental effect is detected, additional mitigation will be evaluated to reduce that effect.

Water Quality Monitoring.
A Water Quality Monitoring Plan has been developed and implemented for the project area to:

- Provide a baseline for ongoing and future monitoring and analyses;
- Demonstrate compliance with water quality standards;
- Provide a basis for the validation of the assumptions used in this analysis;
- Assure and demonstrate timely implementation of practices required to protect water quality and water resources, and;
- Assess the effectiveness of Best Management Practices and other Soil and Water Conservation Practices, and to provide a feedback mechanism to correct or improve those practices if they are not meeting objectives.

Chevron, under the Forest Service's supervision, will ensure this monitoring is completed to those standards described in the FEIS.

We will close 1.3 miles of existing roads to public use

The closure of 1.3 miles of existing road, in addition to the obliteration of 2.4 miles of Main Fork Road, will keep the miles of road open to the public constant with that open prior to this project. The 1.3 miles of road to be closed is just south of the Lily Lake sewage treatment plant and paralleling the overhead power line. This closure would result in a zero net gain in road density in this Road Management Unit.

REASONS FOR THE DECISIONS

There are many people interested in what we do (or do not do) in management of the Main Fork drainage. I am very much aware that many of these people want to preserve the Main Fork in its present condition; I can appreciate this. I am also very much aware of the multiple use role that is the National Forest's mandate.

Having read the public comments on the Draft Environmental Impact Statement and talked with many of the people interested in and affected by the decisions I have to make, I realize no decision I make will satisfy everyone. I can only reaffirm that I have listened to people's comments and concerns and taken them into account.

One of the primary considerations I have taken into account in making this decision is the land allocations of the Forest Plan, approved following a great deal of public involvement in 1985. This area is to be managed for a variety of purposes including livestock grazing, timber management, and potential oil and gas development. The area is to continue to provide recreation opportunities, quality water, and wildlife habitat. This area was leased for oil and gas exploration and development. Thus, the decision I have to make here is whether or not the proposal presented by Chevron is consistent with laws and regulations governing management of this National Forest; with the Forest Plan management direction for the area; and with the intent underlying the existing lease and its associated stipulations. In addition, the proposal has been studied to determine if there are any resource concerns that were not understood when the lease was granted and to determine if resource protection and management concerns could be addressed through mitigation, management requirements, monitoring and so on. I believe the proposal by Chevron, as it has been modified by this decision and with the described mitigation and monitoring requirements is consistent with laws, regulations, the Forest Plan, and the rights granted in the lease.

Another consideration in making this decision was the recently completed eligibility inventory for Wild and Scenic Rivers and the associated analysis of effects this proposal may have on rivers found to be eligible. The portion of the Stillwater River from the wilderness to its confluence with the Bear River was found to be eligible for possible inclusion in the Wild and Scenic Rivers system. Since an existing road and bridge would be used to cross the Stillwater and little roadwork would be done within the visual corridor of the river, this project would not affect the free-flowing character of the river, the outstandingly remarkable scenic value of the river or its classification.

It seems to me that a lot of the discussion about the decisions we have to make centers around what is appropriate within an area that is currently unroaded and relatively pristine. Construction of the drill pad and access road will affect approximately 1095 acres of land that has roadless characteristics. Although there has, historically, been human activities in the area (railroad tie cutting, for example), much of the area is considered roadless and was considered for inclusion in the Wilderness system. Congress, in the Utah Wilderness Act of 1984, did not include these acres in their designation of the High Uintas Wilderness. The area between the Wilderness boundary and the inventoried roadless area boundary was released by the 1984 Wilderness Act for multiple use management.

In the Congressional records, the House report states:

> "The Forest Service's boundary on the north slope from the East Fork of Black's Fork west to Hell Hole Lake was pulled back in order to exclude areas of keen interest for oil and gas exploration and

> possible development. In making these deletions, the Committee would emphasize that the deleted lands have excellent wilderness potential (they comprise some of the lands most readily accessible to residents of the Salt Lake City area and contain several popular trails) and that oil and gas activities should be conducted in such a manner as will minimize environmental disruption and protect wildlife and recreation values. In the event that oil and gas exploration indicates a lack of commercially valuable hydrocarbons in the area, the Committee believes a future Congress may wish to reconsider the wilderness potential of these lands."

The Senate report states:

> "The Committee also notes that the southern flank of the Rocky Mountain overthrust belt extends into the north slope region. The geologic feature may contain substantial oil and gas deposits. The Committee anticipates substantial exploration and possible development of those resources north of the wilderness boundary consistent with the National Environmental Policy Act and other applicable law".

The Forest Plan, in providing management direction for the Forest, designated the area directly adjacent to and including the project area as suitable for timber management; available for oil and gas leasing, and where one could expect to find recreational opportunities in a roaded but natural appearing setting. Thus, though the area is currently roadless, it was not expected to remain roadless as a result of implementation of the Forest Plan.

In spite of these decisions, some people, I know, regard any development of previously unroaded tracts of National Forest to be an unacceptable intrusion, regardless of the size of the area involved. Not only do they not want any development of areas not currently developed, but some recognize that in the future Congress could add to the designated Wilderness from the acres of inventoried roadless lands that have remained unroaded. I am very much aware of the characteristics the Main Fork drainage has. The difficult access has kept the number of visitors to a minimum and those people who have been able to find their way into the area and higher up into the Wilderness, at many times, may have had the place to themselves. I can appreciate this.

As most people know, it is my responsibility to balance competing, often mutually exclusive, expectations and demands to arrive at my decision. I feel my decision provides for resource development while minimizing impacts to the special intangible attributes of the Main Fork drainage.

I want to note one area of public comment regarding the roadless area. Approximately 2120 acres of Roadless Area 19001 (High Uintas Roadless Area) as defined in the 1983 inventory are within the Main Fork drainage area. Depending on one's perception and values, the proposed action in this decision will directly and indirectly modify approximately 730 acres (about 34 percent of the roadless area within the Main Fork drainage). The Forest Service recognizes that there are lands outside of the High Uintas Roadless Area which also contain roadless characteristics (approximately 2645 acres within the Main Fork drainage) and consequently more acres are being modified by the proposed action (approximately 1095 acres or 41 percent of the roadless area within the Main Fork that they recognize).

Thus, while there are impacts on the roadless characteristics of the roadless area, I believe they are within the realm of impacts assumed for the area when the Utah Wilderness Act released the area from consideration for wilderness designation and the Forest Plan allocated the area to various management activities that might require roading and development. There are about 64,770 acres (1 percent decrease) of Roadless Area 19001 remaining in an undeveloped condition across the North Slope.

I have reviewed the significant issues and the comment letters and feel I understand how various interest groups are affected. I have also studied the Environmental Consequences, Chapter IV in the EIS, and am satisfied that the basic soil, water and air resources will not be unacceptably affected by my decisions. I have reviewed Forest Plan direction and feel that the goals and objectives will be met. Some of those goals specifically related to the issues are:

Goal #1, p. IV-1: "Provide the National Forest's share of developed recreation opportunities for all segments of the public."

Goal #5, p. IV-4: "Provide a broad spectrum of low cost dispersed recreation opportunities. Encourage other landowners to provide opportunities also."

Goal #11, p. IV-6: "Protect the cultural resources located on the Wasatch-Cache National Forest from land disturbing activities and public vandalism."

Goal #31, p. IV-12: "Maintain existing water quality on all surface waters of the National Forest to comply with State water quality standards and anti-degradation policy."

Goal #36, p. IV-14: "Integrate the exploration and development of mineral and energy resources on the Forest with the use and protection of other resource values."

Goal #37, p. IV-14: "Administer the mineral resources of the Wasatch-Cache National Forest to provide for needs of the American people and to protect and conserve other resources."

The Chief of the Forest Service, in a letter dated June 4, 1992, directed us to use an ecological approach in the multiple-use management of the National Forests. By that, he said he means "that we must blend the needs of people and environmental values in such a way that the National Forests and Grasslands represent diverse, healthy, productive, and sustainable ecosystems." Two of the four basic management principles he cites are particularly relevant here.

-- "Take Care of the Land" by protecting or restoring the integrity of its soils, air, waters, biological diversity and ecological processes.

-- "Use Resources Wisely and Efficiently to Improve Economic Prosperity" of communities, regions, and nations by cost-effective production of natural resources such as wood fiber, water, minerals, energy, forage for domestic animals, and recreation opportunities.

I believe the decision I make here protects the land and resource values, with the exception of the roadless values associated with 1095 acres while at the same time affording wise exploration for energy resources.

I am satisfied that the decisions I have made here have no effect on the viability of the sensitive wildlife and plant species found in the area. After reviewing the Biological Assessment/Evaluation and Environmental Consequences, Chapter IV in the EIS, I feel comfortable that the Proposed Action would not adversely affect these species' viability. Guidance regarding habitat inventory and/or protection presented in the Biological Assessment/Evaluations for all sensitive species will be followed.

I have also reviewed the Biological Assessment/Evaluation to disclose the effects of management activities on threatened and endangered species. It indicates that no critical habitat is found within the project area and that no threatened or endangered species will be affected.

I am, however, well aware of the other wildlife species, game and non-game, which depend on the area's ability to provide food and security. I am comfortable that this project will not eliminate either food or security cover to the point of significantly affecting wildlife numbers. By restricting public motorized access after September 15, game animals will not be pressured to leave the area and should allow for a quality experience during hunting season. Experience with the oil fields on the Mountain View Ranger District and the Big Piney Ranger District, Bridger-Teton Nation Forest, has shown that even if the well is a producer, by managing traffic, big game wildlife species will not vacate the area and can adapt to the activity.

I am aware of the stress humans can place on big game wildlife species especially during periods where the animals are using significant amounts of energy. The condition they arrive in at their winter ranges depends to a degree on the stress they encounter during their migration from summer ranges. Elk from the Stillwater and Main Fork drainages will concentrate together and migrate through the Peninsula area

during November. I am comfortable that the travel restriction to public motorized vehicles from September 15 to the following spring will adequately mitigate the stress humans will place on the elk during their migration. I am also satisfied that the restrictions placed on the use of the roads behind the Stillwater bridge will minimize any negative impact to goshawk habitat.

PUBLIC INVOLVEMENT

Integral to and initiating the environmental analysis process is the solicitation of comments from the various Federal, State, County, and local agencies, and interested organizations and individuals to assist in incorporating the most accurate and current environmental information and public opinion into planning and decision making. The initial opportunity to comment on the project was "scoping" - an information-gathering process open to the public early in the process.

In early September 1991, the Forest mailed a scoping document in the form of a newsletter to the 227 parties on the project mailing list. On September 17, 1991, a Notice of Intent to conduct environmental analysis was published in the Federal Register. The scoping period ended in early October 1991.

A total of 116 commentors responded to the solicitation. The comments received were reviewed and summarized, and assisted in identifying the range, or scope, of issues and concerns to be addressed during the environmental studies in preparation of the environmental document. The comments ranged from full support of the project to strong opposition. Issues identified from the comments are listed below.

(1) The effects of drilling and production of the oil well on local and state economies. Concerns were expressed regarding the effects of this project and potential subsequent oil projects (primarily production), to local, State, and Federal economies. Development would provide economic benefits; from tax revenues, jobs, goods and services; for the affected State and local economies, as well as the Federal government. Such benefits would alleviate tax burdens and provide needed funds for the affected communities. Also, the increase in domestic production of energy resources would reduce the United States' dependence on foreign energy resources.

Other concerns were expressed that the potential economic benefits would be negligible compared to the potential effects to the natural resource values of the area.

(2) The effects of drilling and production of the oil well on the values and characteristics of the roadless area. Concerns were expressed regarding the potential impacts to the roadless area. Some individuals believe that new roads in the area would result in increased human intrusion and cause irreparable change to the roadless area. They believe that the values of solitude provided by the area are unique and should not be affected.

(3) The effects of drilling and production of the oil well on wildlife species and habitat. Concerns were expressed regarding the potential effects to the wildlife and habitat of the area, which is presently undiminished.

(4) The effects of drilling and production of the oil well on existing recreation uses in the area. Concerns were expressed that the effects of the project would alter the recreational setting and experience presently provided by the area. Roads introduced into the area would provide access for vehicles and promote increased human activity. Recreationists favoring rustic, dispersed recreation opportunities believe that the uses of recreation and the drilling and production of the oil well are incompatible and oppose development in this area. Expressed in relation to this concern, were the effects of this project on other resources such as wildlife, habitat, water, etc. (which are included in discussions of other issues).

Other recreationists favor the opportunity for increased access into these areas - leaving roads open to the public, reclaiming the well site upon completion of project activities, and developing recreation sites such as trailheads.

(5) The effects of drilling and production of the oil well on road management in the future. As mentioned previously, some individuals expressed concern that roads introduced in the area would provide access for vehicles and promote increased human activity - resulting in both direct and indirect impacts to the area.

Other recreationists favor the opportunity for increased access into these areas - leaving roads open to the public.

(6) The effects of drilling and production of the oil well on water quality in the Stillwater drainage. Concerns were expressed that ground-disturbing activities associated with the project (construction, drilling, and production) would disturb soils and could cause consequent effects on soils and water. Potential effects to soils include compaction, displacement, and loss of vegetation cover resulting in erosion. Soil-disturbing activities, such as construction and vehicular traffic, could result in erosion, or other displacement of soils (for example, at stream crossings) may cause sedimentation in streams with consequent degradation of water quality and aquatic habitat (for example, fisheries).

Other effects to water quality could result in contamination of ground and surface water from possible fuel and/or oil spills.

(7) The effects of drilling and production of the oil well on the aesthetic and visual characteristics of the area. Concerns were expressed regarding the effects of project activities on the natural beauty of the area, particularly from the Mirror Lake Highway. Some comments addressed the temporary nature of the activities that are considered most obtrusive to the character of the area (that is, primarily drilling).

(8) The effects of drilling and production of the oil well on the water supply to the Christmas Meadows summer-home area. Concerns were expressed regarding the potential effects of project activities on the quantity of nearby spring water used for domestic use by the residents of the Christmas Meadows summer-home area.

Following review and analysis of the comments received, project personnel from the Forest met on October 31, 1991, to discuss the issues and determine the type of documentation needed. Public comments demonstrated a wide range of concern over effects of introducing a road into a roadless area. The decision to prepare an environmental impact statement (EIS) rather than an environmental assessment was made. A Notice of Intent to prepare an EIS was published in the Federal Register on January 8, 1992. Public comments were accepted until January 31, 1992. These comments plus comments received during the scoping period were used in directing the preparation of the EIS.

The Draft Environmental Impact Statement (DEIS) was released for public review in December, 1992. Copies of the DEIS were sent to all interested parties identified during the scoping process and appropriate local, State and Federal agencies. Two public open houses were held (Salt Lake City, Utah, and Evanston, Wyoming). In addition, a public meeting was held in Salt Lake City, Utah at the request of the public. The purpose of the open houses and public meeting was to answer questions, clarify parts of the document, and gather comments.

One hundred twenty one letters were received during the comment period which ran from December 24, 1992 to February 19, 1993. All comments were reviewed, including those received after the February 19, 1993 deadline, and are on file and available for public review at the Evanston Ranger District office. The Forest reviewed and considered these, and the comments received at the open houses and the public meeting. Changes in the Final EIS (FEIS) were based upon the comments and on further analysis by the Forest Service. No decisions were based upon the quantity of comments received on a particular issue.

Numerous respondents either favored or opposed the proposal, or made personal statements of preference. These people are directed to my rationale for my decision within this Record of Decision which explains the reasons for the decisions I have made.

ALTERNATIVES CONSIDERED

The intent was to formulate a range of reasonable alternatives that addressed the issues developed during the scoping and public involvement process. Other alternatives were considered, but for various reasons were eliminated from detailed analysis as documented in the FEIS. The following were considered in detail.

Well Site Locations

1. Alternative NA (No Action)

This is the "No Action" alternative required by the Council of Environmental Quality regulations implementing the National Environmental Policy Act (NEPA). The "No Action" means the project would not be implemented as proposed.

2. Well Site A (Preferred Well Site Alternative)

The Well Site would be located in T.1N., R.10E., SW 1/4 SW 1/4 of Section 16. The pad would occupy approximately 3.43 acres on the west slope of the Main Fork drainage.

3. Well Site B

The Well Site would be located in T.1N., R.10E., NW 1/4 NE 1/4 of Section 21. Pad size would be the same as above; however, it would be located on the top of the ridge separating the Main Fork drainage from the Stillwater drainage. It also would require an additional 1.6 miles of road above that described in #2 above.

Access Alternatives

1. Stillwater/Peninsula Road (Preferred Road Location Alternative)

Road construction would involve upgrading 0.8 mile of the Stillwater Road, upgrading 2.1 miles of the Peninsula Road, constructing 2.0 miles of road on the east side of the Main Fork, constructing a bridge across the Main Fork, and constructing 0.8 mile of road the rest of the way to the well site.

Two other road location alternatives and helicopter access were considered but eliminated from detailed analysis.

Road Management Alternatives

1. Open Road Management Alternative (Preferred Alternative)

All of the road used for access except for the last 0.8 miles leading to the drill pad would be open to the public once construction and drilling operations are completed. A seasonal closure to the public beginning at the existing Stillwater bridge will be implemented from September 15 to sometime after May 1, depending on weather and road conditions. Public use would not be allowed past the Stillwater bridge during the nesting period when the goshawk nest adjacent to the Peninsula Road is occupied. A small parking/trailhead area will be constructed near the end of the existing jeep trail to be used by hikers heading into Hell Hole basin.

2. **Closed Road Management Alternative**

The road starting at the Stillwater bridge would remain closed to public motorized travel at all times.

3. **Reclaimed- or Rehabilitated-Road Management Alternative**

If the well is unsuccessful, the new road from the end of the Peninsula Road into the drill site would be reclaimed and reseeded.

Gravel Source Alternatives

Source C (Preferred Gravel Source Alternative)

This source is located in NE1/4 NE1/4 of Section 8, at the end of the Peninsula Road. The site contains more clay-type binding material and would provide more stable, longer lasting surfaces. It appears to have enough minute (fines) particles and rocks to make gradation without large piles of rejected material.

Two other gravel sources were considered but eliminated from detailed analysis.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

Alternative NA (No Action) is the environmentally preferred alternative. Implementation of this alternative would result in little or no ground disturbing activities in the short term.

FINDING REQUIRED BY OTHER LAWS

The Forest Plan has been reviewed and a determination made that this decision is consistent with the Wasatch-Cache Forest Plan. The actions in this project comply fully with the goals of the Forest Plan, the Management Area Direction and the Forest-Wide Standards and Guidelines with the following exception:

> The redefined old growth stands need to be designated and the currently designated old-growth stands eliminated as previously described.

Specific changes made are documented in the attached plan amendment. The analysis of these changes is included in the EIS. I conclude that this is a nonsignificant amendment to the Forest Plan.

Floodplains, wetlands, prime lands, threatened and endangered species, and cultural resource management implications have been considered and these resources will not be adversely affected.

The goals in the Forest Plan are on pages IV 1-23. Forest Wide Standards and Guides are on pages IV 24-50. The Management Areas involved on the North Slope are on pages IV 73-104.

MITIGATING MEASURES

All practicable means have been adopted to avoid or minimize environmental impacts that may result from the alternative selected. The selected alternative incorporates the mitigation measures, road and drill pad construction criteria and Best Management Practices discussed in the EIS. The Forest-Wide and Management Area Standards and Guides also ensure environmental impacts are minimized. In addition to the mitigation measures identified in the EIS in Chapters 2 and 4, and the Biological Assessment/Evaluation, the following EIS Appendices contain additional descriptions and clarification:

Appendix A - Authorizing Actions
Appendix B - Application for Permit to Drill and Surface Use Plan
Appendix C - Road Construction Criteria
Appendix D - Summary of Mitigation and Monitoring
Appendix E - Erosion Control and Reclamation

IMPLEMENTATION DATE AND APPEAL OPPORTUNITIES

This decision may be implemented 45 days after publication in the Salt Lake Tribune. Copies of this Record of Decision, EIS, and the file of public comments are available for public review at the following location:

Wasatch-Cache National Forest
Evanston Ranger District
1565 Hwy 150 South, Suite A
Evanston, WY 82930

This decision is subject to administrative review pursuant to the appeal regulations, 36 CFR 215. Any appeal of this decision must be fully consistent with 36 CFR 215.14. Two copies of the Content of Notice of Appeal, including the reasons for appeal, must be filed with the Regional Forester, Intermountain Region, 324 25th Street, Ogden, UT 84403, within 45 days from the date of publication in the Salt Lake Tribune.

For further information contact Stephen Ryberg, District Ranger, at the Evanston Ranger District or telephone (307) 789-3194.

Susan Giannettino

SUSAN GIANNETTINO
Forest Supervisor
Wasatch-Cache National Forest
8230 Federal Building
125 South State Street
Salt Lake City, UT 84138

1/6/94
Date

WASATCH-CACHE LAND AND RESOURCE MANAGEMENT PLAN

AMENDMENT NO. 20

Effective 1/4/94

POSTING NOTICE: Attach enclosed map to Forest Plan Map 8. No changes in specific Forest Plan wording are required for this amendment.

Explanation:

The analysis to substantiate this change is in the Environmental Impact Statement for Table Top Prospect Oil and Gas Well.

This amendment is a non-significant amendment to the Wasatch-Cache Land and Resource Management Plan. It changes the boundary of a designated old growth stand. In the Forest Plan, old growth stands of conifers were identified for protection. When these stands were identified, the existing Peninsula Road did not appear on any of the maps being used and consequently the designated stand included a road which split the stand into sections having approximately 25 and 284 acres apiece. During the process of this analysis, lands of the same capability classification were located directly adjacent to the larger of the two sections. Twenty five acres will be added to the larger section and designated for protection to replace the smaller section.

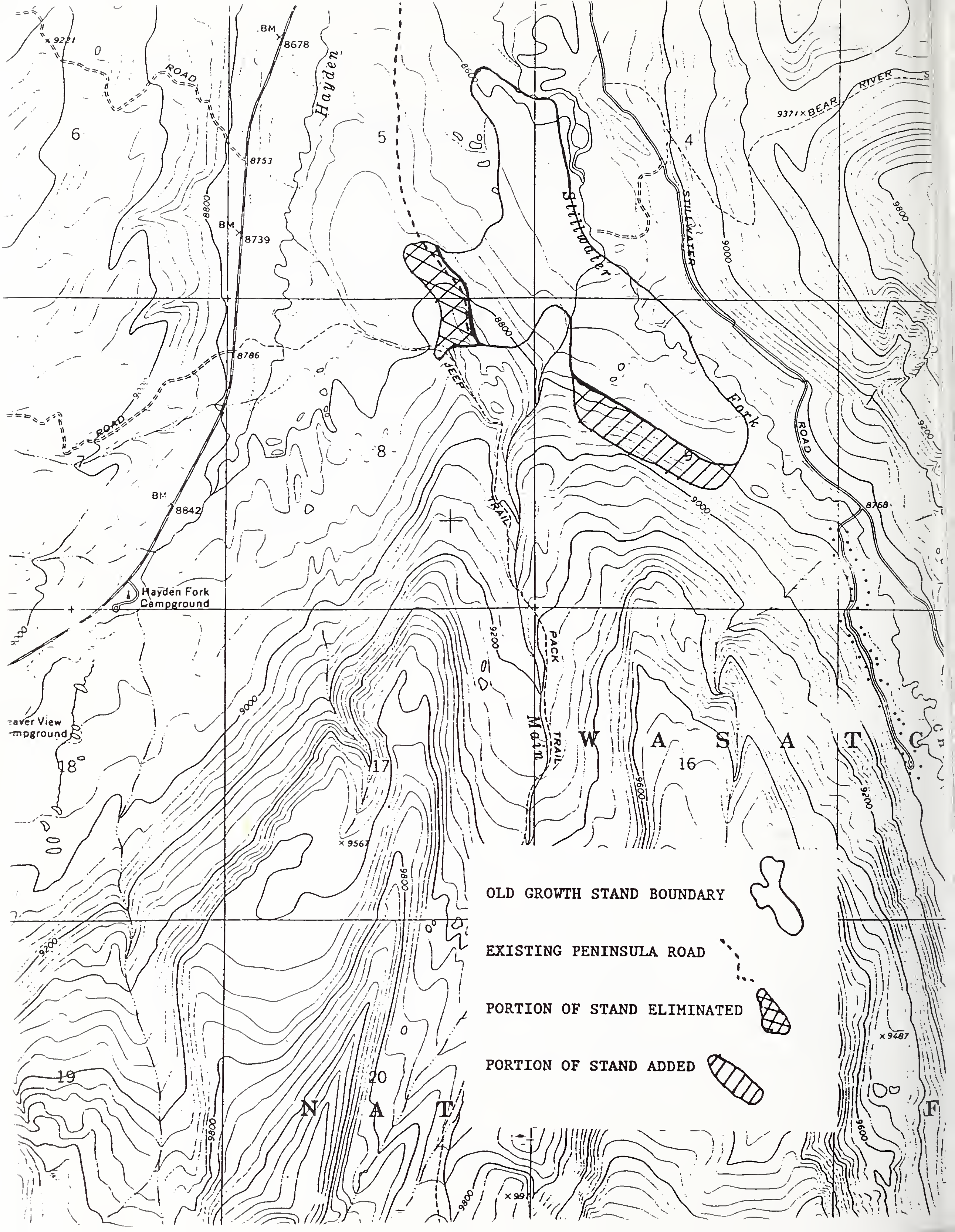
Old Growth Stands

Current Location:

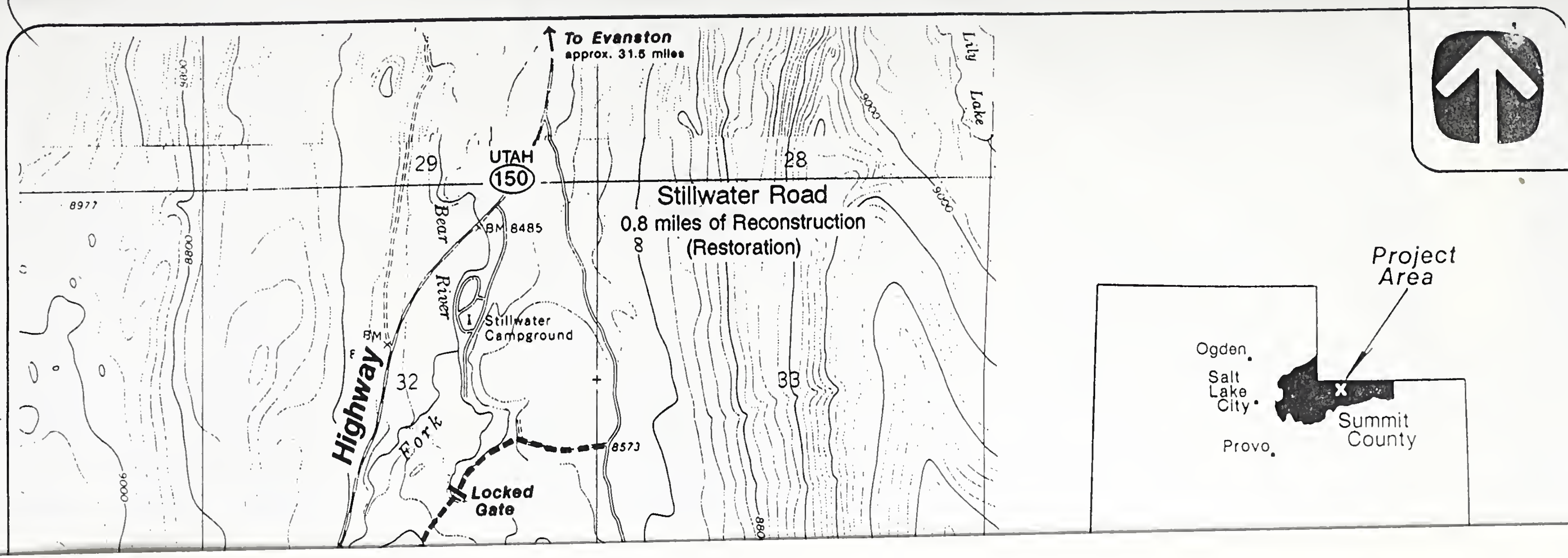
The Old Growth Stand Map, (Map #8) included in the Forest Plan package, shows the location of the designated old growth stand within the project area. T.1N., R.10E., SW1/4 NW1/4, W1/2 SW1/4, SE1/4 SW1/4, Section 4; SE1/4 NE1/4, E1/2 SE1/4, SW1/4 SE1/4, Section 5; N1/2 NE1/4, Section 8; NW1/4, W1/2 NE1/4, NW1/4 SE1/4, Section 9.

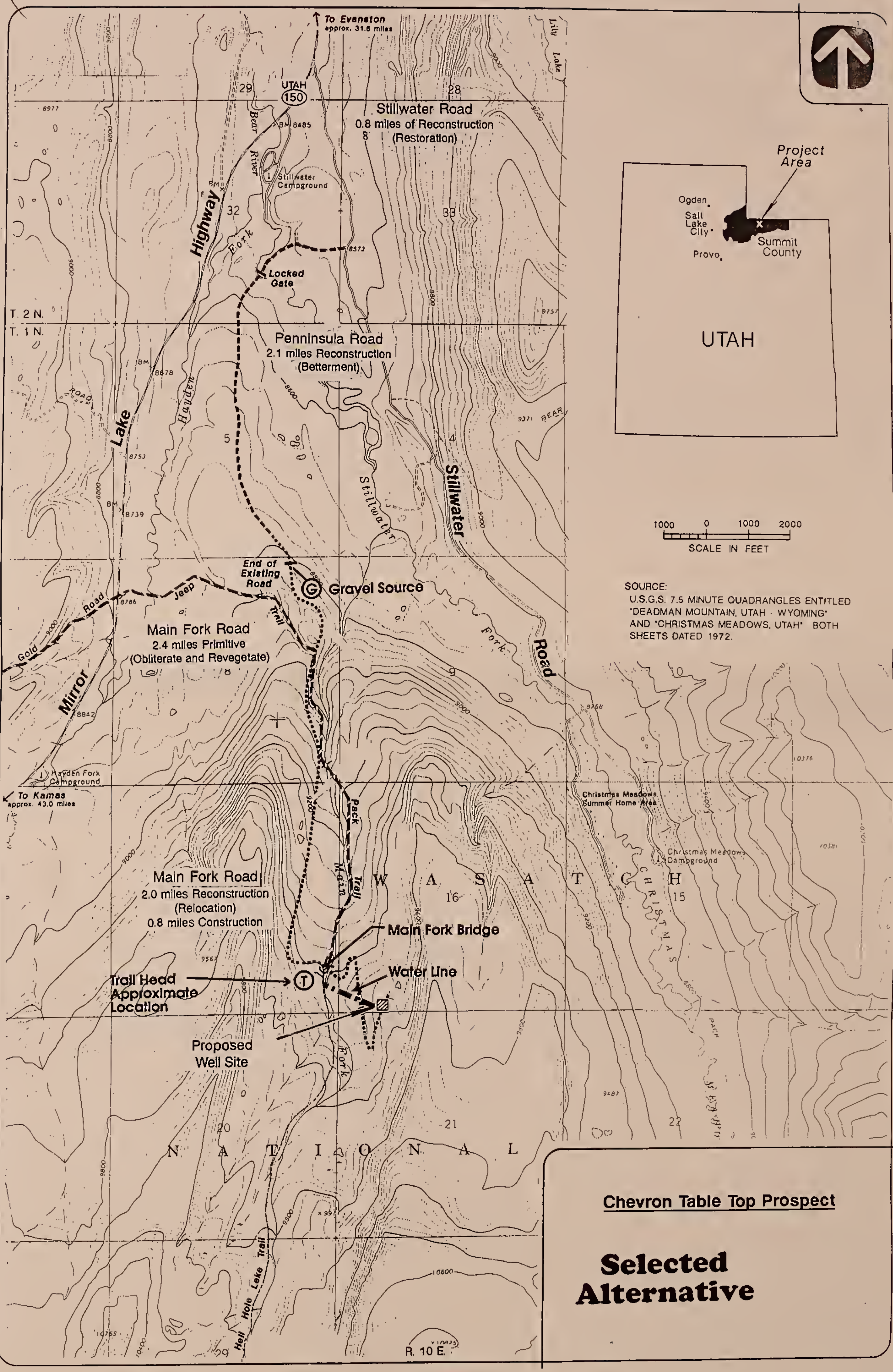
Amended Location:

The Old Growth Stand Map, (Map #8) included in the Forest Plan package, is amended to reflect the adjustment of stand boundaries as shown on Figure 3-5 in Chapter three of the Exploratory Oil Well - Chevron Table Top Prospect EIS (copy attached) and as described here: T.1N., R10E., replace old growth stand on west side of Peninsula Road (Forest Road No. 306) in SW1/4 SE1/4, Section 5; and NW1/4 NE1/4, Section 8 with timber stand in S1/2 NW1/4, NE1/4 SW1/4, NW1/4 SE1/4, Section 9.



ROAD
Hayden
BM 8678
9221
8753
BM 8739
8800
8786
ROAD
BM 8842
Hayden Fork Campground
Beaver View Campground
Stillwater
Fork
STILLWATER
ROAD
BEAR RIVER
9371
JEEP
TRAIL
PACK
TRAIL
Main
W A S A T C
N A T
F
9000
9200
9600
9800
9567
9487
8768
OLD GROWTH STAND BOUNDARY
EXISTING PENINSULA ROAD
PORTION OF STAND ELIMINATED
PORTION OF STAND ADDED


To Evanston
approx. 31.5 miles
UTAH
150
Stillwater Road
0.8 miles of Reconstruction
(Restoration)
Lily Lake
29
28
32
33
Bear River
Fork
BM 8485
Stillwater Campground
Highway
8573
Locked Gate
8977
8800
9000
Project Area
Ogden
Salt Lake City
Provo
Summit County



Chevron Table Top Prospect

Selected Alternative